Tennessee Department of Environment and Conservation

Division of Ground Water Protection

"Draft"
Soils Handbook

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Table of Contents 2

PREFACE

Tennessee Code Annotated, 68-221-401 mandates that subsurface sewage disposal systems be located, constructed and maintained in a manner that:

1) Do not contaminate any drinking water supply;
2) Are not accessible to rodents, insects or other potential carriers of disease;
3) Do not pollute or contaminate surface or ground water;
4) Are not a health hazard by being accessible to the general public;
5) Do not cause a nuisance due to odor or unsightly appearance; and
6) Will not violate any other laws or regulations governing water pollution or sewage disposal.

It is the Tennessee Department of Environment and Conservation's Division of Ground Water Protection's responsibility to ensure the mandates of this statute are met. In order to accomplish the mandates of the statute, the Division has developed the Regulations to Govern Subsurface Sewage Disposal Systems. These regulations address all aspects of subsurface sewage disposal systems.

Of the factors that influence the performance of a subsurface sewage disposal system, soil suitability is arguably the most critical. The regulations contain soil suitability requirements for subdivision approval and issuance of subsurface sewage disposal system permits. Subdivision approval and subsequent permit issuance, as allowed by the regulations, has evolved from being solely based on percolation tests to being largely based on results of soil mapping. This evolution has resulted in the ever-increasing role of soils consultants in the day-to-day function of the Division's activities.

Rule 1200-1-6-.17 of the Regulations establishes the process by which an individual can achieve the status of "Approved Soils Consultant". Regulations 1200-1-6-.02(3)(a)(3) and 1200-1-6-.03(1) allow for the work of private soils consultants to be utilized by the Division for subdivision approval and permit issuance in the same capacity as the work performed by state-employed soils consultants. By these regulations the industry of "Private Soils Consultant" was developed and is currently maintained.

This "Soils Handbook" has been prepared as a document that provides instruction and clarification to both new and approved soils consultants in order that they may provide consistent, accurate, and reliable information to be used by Division staff. The base of the Soils Handbook is founded on statute and regulation and as a result variation of the product produced by private soils consultants should be minimal. However, as would be expected with dozens of private soil consultants working independently of each other over the last several years, variation in the final mapping product among private soils consultants has grown increasingly wide. This handbook provides a baseline of standard practices for soil mapping and presentation for the Division's purpose.

The role of the Division with respect to applicants for permits or subdivision evaluations is to ensure that, prior to approval, an appropriate amount of suitable soil has been identified for the purpose of supporting onsite disposal of sewage for each subdivision lot created or for each permit issued. The role of soils consultants with respect to the Division's objectives is to provide an evaluation of the site with respect to its suitability for subsurface sewage disposal systems, and accurately present this evaluation in a format that can be successfully interpreted and applied by Division personnel. When accurate soil maps are applied correctly by environmental specialist staff; and installations conform to the Regulations to Govern Subsurface Sewage Disposal Systems and the site specific permit for construction, suitable long-term system performance can be expected. However, when an environmental specialist inadvertently uses an inaccurate soil map in support of permit preparation, the consequences may be significant. The system, even if constructed correctly, may not function and the soil intended for repair purposes may not provide an adequate area to replace the system.

Since soil maps prepared by soils consultants are ultimately used in support of permit issuance for subsurface sewage disposal systems and permits for these systems pave the way for home construction, it follows that the accuracy of these maps is a critical factor in the economic security of the owner of the property. In other words, the consequences of an inaccurate soil map are far-reaching and expensive. A house with a failing septic system is of little value unless the system can be adequately repaired. In the event there is inadequate suitable soil to facilitate a conventional repair to the system, the only repair option may be an alternative or experimental type of system. If these are not legitimate options, the owner may be left with a system that will never adequately support the home. The value of homes with chronic septic system failures for which there is no long-term repair is significantly depreciated from the value of similar homes with functioning systems.

The success of the Division's program is largely dependent on the accuracy of soil maps and their proper application by staff environmental specialists. The intent of this handbook is to provide a document to be used as a guideline through which accurate soil maps are generated and the information on the maps is consistently and uniformly presented. Accurate maps that present necessary information in a consistent manner will prepare a solid foundation that, when accompanied with proper application, will ensure homeowners a functional long-term means of onsite sewage disposal.

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Soils Handbook Glossary

Not all the terms in this glossary are in the Soils Handbook. Included are terms commonly used by Soils Consultants and Soil Scientists.

A

Aerate means to allow or promote exchange of soil gases with atmospheric gases.

Aggregate is a unit of soil structure formed by natural processes as opposed to artificial processes, and generally, 10 mm in diameter.

Alluvial is pertaining to processes or materials associated with transportation or deposition by running water.

Alluvium-Colluvium – soil material, rock fragments, or both, moved by a combination of water and gravity and deposited at the base of slopes; utilized by the department for interpretive purposes (i.e. site stability, etc.)

Alternative/experimental methods of disposal mean a subsurface sewage disposal system, the construction, installation and operation of which varies from that of a conventional subsurface sewage disposal system.

Aqualfs are Alfisols that are saturated with water for periods long enough to limit their use for most crops other than pasture or woodland unless they are artificially drained. Aqualfs have mottles; iron-manganese concretions or gray colors in the argillic horizon. (A suborder in the U.S. system of soil taxonomy).

Aquents are Entisols that are saturated with water for periods long enough to limit their use for most crops other than pasture unless they are artificially drained. Aquents have low chromas or distinct mottles within 50 cm of the surface, or are saturated with water at all times. (A suborder in the U.S. system of soil taxonomy).

Aquepts are Inceptisols that are saturated with water for periods long enough to limit their use for most crops other than pasture unless they are artificially drained. Aquepts have either a histic or umbric epipedon and gray colors within 50 cm of the surface, or an ochric epipedon underlain by a cambic horizon with gray colors, or have sodium saturation of l5% or more. (A suborder in the U.S. system of soil taxonomy).

Aquic is a mostly reducing soil moisture regime nearly free of dissolved oxygen due to saturation by ground water or its capillary fringe and occurring at periods when the soil temperature at 50 cm below the surface is above 5 degrees Celsius.

Aquic Conditions - Continuous or periodic saturation (with water) and reduction, commonly indicated by redoximorphic features.

Aquolls are Mollisols that are saturated with water for periods long enough to limit their use for most crops other than pasture unless they are artificially drained. Aquolls may have a histic epipedon, a sodium saturation in the upper part of the mollic epipedon of > 15% that decreases with depth or mottles or gray colors within or immediately below the mollic epipedon. (A suborder in the U. S. system of soil taxonomy).

Aquults are Ultisols that are saturated with water for periods long enough to limit their use for most crops other than pasture or woodland unless they are artificially drained. Aquults have mottles below the Al and Ap horizons in the argillic horizon. (A suborder in the U.S. system of soil taxonomy).

Arents are Entisols that contains recognizable fragments of pedogenic horizons that have been mixed by mechanical disturbance. Arents are not saturated with water for periods long enough to limit their use for most crops. (A suborder in the U.S. system of soil taxonomy).

Argillic Horizion – a mineral horizon that is characterized by the illuvial accumulation of layer-lattice silicate clays. The argillic horizon has a certain minimum thickness depending of the thickness of the solum, a minimum quantity of clay in comparison with an overlying eluvial horizon depending on the clay content of the eluvial horizon and has coatings of oriented clay on the surface of pores or peds or bridging sand grains.

Association, Soil is a group of soils geographically associated with a characteristic repeating pattern, usually defined and delineated as a single map unit.

Available water capacity - (available moisture capacity). Approximately the amount of available water to plants in a soil is the water retained between tensions of 1/3 atmosphere (field capacity) and the permanent wilting point for most plants (15 atmospheres).

B

Bedding planes -Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock is the solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface. Examples of bedrock may be shale, sandstone, dolomite, limestone, and granite.

Berm, Diversion – a ridge of earth, generally a terrace (similar to an agricultural

terrace), built to protect down slope areas by diverting surface runoff from its natural course.

Blocking layer (Division of Ground Water Protection) is a horizon or layer in the soil that impedes or stops the movement of liquids through the soil.

Bottomland is the normal flood plain of a stream, subject to flooding.

Boundary outline means a map or chart with lines delineating the boundaries of the proposed area or parcel of land.

Buffer zone means the distance between subsurface sewage disposal system or subsystems required to alleviate the impact of hydraulic overloading from adjacent system(s).

Bulk Density is the mass of dry soil per unit bulk volume. The bulk volume is determined before drying to constant weight at 105 degrees Celsius. The value is expressed in mega grams per cubic meter.

C

Chroma is the relative purity, strength, or saturation of a color, directly related to the dominance of the determining wavelength of the light and inversely related to grayness; one of the three variables of color. See Munsell color system, hue, value, and chroma.

Clay as a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil texture class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay Film - A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: Clay coat, clay skin, or argillans.

Claypan is a dense, compact layer in the subsoil having a much higher clay content than the overlying material, from which it is separated by a sharply defined boundary; formed by downward movement of particles or may have been formed in alluvial materials.

Closed Depression – an area of lower ground indicated on a topographic map by a hachured depression contour line forming a closed loop; e.g. a hollow below the general land surface with no surface outlet.

Coarse fragments - If rounded, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstones) 2 mm to 38.1cm (6 to 15 inches) long.

Colluvium - Soil material, rock fragments, or both moved by gravity, creeps, or slides and deposited at the base of slopes.

Commissioner means the commissioner of the Department of Environment and Conservation, his duly authorized representative, and in the event of his absence or a vacancy in the Office of Commissioner, the Deputy Commissioner.

Complex, Soil- A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions - Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate, manganese or iron oxide are common compounds in concretions. It has crude internal symmetry organized around a point, line, or a plane.

Consistency - The resistance of a material to deformation or rupture. (ii) The degree of cohesion or adhesion of the soil mass. Terms used for describing consistency at various soil moisture contents are:

Wet soil - non-sticky, slightly sticky, sticky, non-plastic, slightly plastic, plastic, and very plastic.

Moist soil - loose, very friable, friable, firm, very firm, and extremely firm.

Dry soil- loose, soft, slightly hard, hard, very hard, and extremely hard.

Cementation - weakly cemented, strongly cemented, and indurated.

Consultant – a soils consultant approved by the Department to do soil mapping for the planning of on-site sewage disposal systems in the State of Tennessee.

Control section - The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 and 40 inches.

Conventional Subsurface Disposal Sewage Disposal System means a system that pretreats sewage by use of a septic tank and applies effluent to the soil as described in Rule 1200-1-6-.06.

Cutan- A modification of the texture, structure, or fabric at natural surfaces in soil

materials due to concentration of particular soil constituents or in situ modification of the plasma.

Grain Cutan- Cutan associated with the surfaces of skeletan grains or other discrete units such as nodules, concretions, etc.

Illuviation Cutan- See Clay Films

Cut Bank - consists of banks, commonly but not everywhere, along sides of roads, borrow areas, mines, pits, construction, excavated areas, etc. created by the mechanical removal of soil material.

Cut Line – the manual and/or mechanical (typically by hand labor) clearing of the vegetation along the lines of a soil-mapping grid. The vegetation is cut down to allow for a clear line of sight along the entire length of all gridlines.

D

Delineation - A portion of a landscape shown by a closed boundary on a soil map that defines the area, shape, and location of one or more component soils plus inclusions.

Department means the Tennessee Department of Environment and Conservation.

Division – means the Division of Ground Water Protection

Drainage Class - (natural) Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained - Water is removed from the soil rapidly. Many or some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well- drained soils are commonly medium textured. They are mainly free of

mottling.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained- Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table. Additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods; free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and " climatic moors".

Drain, Diversion – see berm, diversion

Drain, Drawdown – a subsurface drain designed to lower a water table or saturated zone in the vicinity or the septic field, usually on slopes ranging from 0% to 3%.

Drain, Curtain - A drainage system that completely encloses a filter field and can be a combination of an interceptor drain and drawdown drain.

Drain, Interceptor - An interceptor drain usually installed upslope of the filter field area to intercept water before it enters the site; usually on slopes greater than 2% and can be 1, 2, or 3 sided.

Drainage, surface - runoff, or surface flow of water, from an area.

Drop out - see soil collapse/soil pipe

Diversion (or diversion terrace) **-** A ridge of earth, generally a terrace, built to protect down-slope areas by diverting runoff from its natural course.

E

Eluvial Horizon- A soil layer(s) or horizon(s) in which material in suspension is removed.

Embankment – a landscape feature, created by natural or man-made erosional influences which result in an abrupt cliff-like formation. Embankments can rise positively (upward) or fall negatively (downward) from the horizontal level.

Endosaturation - The soil is saturated with water in all layers from the upper boundary of saturation to a depth of 200 cm or more from the mineral soil surface.

Episaturation - The soil is saturated with water in one or more layers within 200 cm of the mineral soil surface and also has one or more unsaturated layers, with an upper boundary above a depth of 200 cm, below the saturated layer. The zone of saturation, i.e. the water table, is perched on top of a relatively impermeable layer.

Escarpment – a steep-faced bank or bluff rising abruptly from the land surface.

Extrinsic- Originating outside a part and acting upon the part as a whole.

F

Filled Land means areas to which more than two (2) feet of soil and/or debris have been added.

First Bottom - The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood Plain - A nearby level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot Slope - The inclined generally concave surface at the base of a hill.

Fragipan - A natural subsurface horizon with high bulk density and/or high mechanical strength relative to the solum above, seemingly cemented when dry, but when moist showing a moderate to weak brittleness. The layer is low in organic matter, mottled, slowly to very slowly permeable to water, and usually shows occasional or frequent bleached cracks forming polygons. It may be found in profiles of either cultivated or virgin soils but not in calcareous material. To be

identified as a fragipan, a layer must have **all** of the following

1. The layer must be 15 cm or more thick **and**
2. The layer shows evidence of pedogenesis within the horizon, or at a minimum, on the faces of structural units; **and**
3. The layer has very coarse prismatic, columnar, or blocky structure of any grade, has weak structure of any size, or is massive. Separations between structural units that allow roots to enter have an average spacing of 10 cm or more on the horizontal dimensions; **and**
4. Air-dry fragments of the natural soil fabric, 5 to 10 cm in diameter, from more than 50 percent of the horizon slake when they are submerged in water; **and**
5. The layer has, in 60 percent or more of the volume, a firm or firmer rupture-resistance class, a brittle manner of failure at or near field capacity, and virtually no roots.

G

Gilgai- The micro relief of small basins and knolls or valleys and ridges on a soil surface produced by expansion and contraction during wetting and drying (usually in regions with distinct, seasonal, precipitation patterns of clayey soils that contain smectite. (Vertisols)

Graded land means areas from which soil has been removed and the remaining soil cannot be classified in any soil series.

Grid Staking –the system developed to provide proper ground control (i.e. field located reference points marked with wood stakes) for soil mapping. The name being derived from the manner in which the field stakes are arranged in a grid pattern. A Licensed Land Surveyor can only do grid staking.

Grid-Box Centers (GBC) – the actual center point of a grid box.

Ground Water (geology) - In the broad sense, all water below the ground surface.

Gullied Land means areas where gullies occupy nearly all of the surface area. Areas in which gullies occur within special intervals of less than one hundred (100) feet shall be classified as soil gullied land complex. Gullies of more than one hundred (100) feet spatial intervals shall be located on the soil maps with the designated symbols.

Gully means a miniature valley (more than one foot in depth) cut by running water and through which water generally runs during and shortly after rainfall. Gullies are intermittent stream channels.

H

Horizon, Soil - A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes.

Hue - One of the three variables of color. It is caused by light of certain wavelengths and changes with the wavelength. See Munsell color system: chroma, value, and hue.

Hydric Soils – soils that are saturated, flooded or ponded long enough to periodically produce anaerobic conditions in the upper part of the soil profile, thereby influencing the growth of plants.

Hydrophytic plants – plants that grow in and are adapted to an aquatic or very wet environment.

I

Illuvial Horizon-A soil layer or horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. (The layer of accumulation.)

Intrinsic- belonging to the essential nature or constitution of a thing.

K

Karst- topography with sinkholes, caves, and underground drainage that is formed in limestone, gypsum, or other rocks by dissolution.

Karst Topography- is a landscape where the soil is underlain by limestone (or other soluble rock) or where limestone is so close to the surface that surface water will move through the soil into openings in this soluble rock and directly into the ground water. Sinkholes, sinking streams, caves, and springs characterize these landscapes. They are highly susceptible to pollution and require special protection of the ground water.

L

Lithic contact- the boundary between soil and coherent underlying material that is sufficiently coherent when moist to make hand digging with a spade impractical but may be chipped or scraped with a spade. Cracks that roots can penetrate are few and their horizontal spacing is 10 cm or more.

Lot means a part of a subdivision or a parcel of land intended for the building of a single house, building, or other development where a subsurface sewage disposal system is to be used.

M

Miscellaneous land types means areas on the earth's surface that are non-soil (rocks, water, etc.) and soils that are difficult or impossible to classify in soil series (filled land, graded land, gullied land, paved areas, etc.)

Mottling, Soil - Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage (see variegations).

Munsell Color System - A color designation system that specifies the relative degrees of the three simple variables of color: hue, value, and chroma. For example, lOYR 6/4 is a color (of soil) with a hue = 10 YR, value = 6, and chroma = 4.

N

Nodule-A cemented concentration of a chemical compound, such as calcium carbonate or iron oxide, that can be removed from the soil intact and that has no orderly internal organization.

P

Pan - A compact dense layer in a soil that impedes the movement of water and the growth of roots.

Parent Material- the unconsolidated organic and mineral material from which soil forms.

Paralithic Contact - The contact between soil and underlying material that is relatively unaltered (does not meet the requirements for any other named diagnostic

horizon or any other diagnostic soil characteristic) that have extremely weakly cemented to moderately cemented rupture-resistance class. Cementation, bulk density, and the organization are such that roots cannot enter or the horizontal spacing of cracks that roots can enter is 10 cm or more. Commonly these materials are partially weathered or weakly consolidated bedrock, such as sandstone, siltstone, or shale. Digging manually with an ordinary spade by an ordinary person is impractical.

Ped- A unit of soil structure such as an aggregate, crumb, prism, block, or granule, formed by natural processes (in contrast to a clod, which is formed artificially.)

Pedon- The smallest volume that can be called a soil. It has three dimensions. It extends downward to the depth of plant roots or to the lower limit of the genetic soil horizons. Is lateral cross-section is roughly hexagonal and ranges from 1 to 10 square meters in size, depending on the variability in the horizons.

Percolation Rate means the rate at which water moves into the soil as determined by a percolation test.

Percolation, Soil Water – the downward movement of water through soil, especially the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1.0 or less

Percolation Test means a method of determining the usability of an area for subsurface sewage disposal by testing for the rate at which the undisturbed soil in a series of test holes of standard size will absorb water per unit of surface area.

Permeability, Soil- The quality of soil that enables it to transmit water or air. Permeability is measured as the number of inches per hour that water moves through the saturated soil.

Phase, Soil - A subdivision of a series based on features that affect its use and management, for example: slope, stoniness and thickness.

Plans means any documents required by the Commissioner in the process of carrying out these Regulations. Plans may include, but not be limited to: applications, boundary outlines, plats, soil maps, and topographic maps.

Plat means a map or other graphic representation drawn to scale, of a piece of land subdivided into lots, showing streets, waterlines, lot lines, etc.

Ponding – standing water in a depression that is removed only by percolation, evaporation, and transpiration

Profile, Soil - A vertical section of the soil extending through all its horizons and into the parent material.

R

Recalcitrant Soils Consultant- is a soils consultant who repeatedly commits the same errors or omissions after having been warned, reprimanded or suspended.

Redox Concentrations - Zones of apparent accumulations of Fe-Mn oxides in soils, including:

(1) Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure. Boundaries commonly are diffuse if formed in situ and sharp after pedoturbation. Sharp boundaries may be relict features in some soils; and

(2) Masses, which are noncemented concentrations of substances within the soil matrix; and;

(3) Pore linings, i.e. zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.

Redox depletions -Zones of low chroma (chroma less than those in the matrix) where Fe-Mn oxides alone or both Fe-Mn oxides and clay have been stripped out including:

(1) Iron depletions, i.e., zones that contain low amounts of Fe and Mn oxides but have a clay content similar to that of the adjacent matrix (often referred to as Albans or neoalbans): and

(2) Clay depletions, i.e., zones that contain low amounts of Fe, Mn, and clay (often referred to as silt coatings or skeletans.)

Redoximorphic Features - Soil properties associated with wetness that result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated.

Reduced Matrix - This is a soil matrix that has low chroma in situ but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Regolith - A general term for the entire layer of mantle of fragmental and loose, incoherent, or unconsolidated rock material, of whatever origin (residual or transported) and of every character, that nearly everywhere forms the surface of the land and overlies or covers the more coherent bedrock.

Residuum (residual soil material) - Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Restrictive Horizon – a horizon in the soil (bedrock or fragipan) that impedes or

stops the downward movement of liquids through the soil.

Restrictive Layer- (Division of Ground Water Protection) is any layer in a soil that affects the installation or performance of a subsurface sewage disposal system.

Rill means a small shallow (one foot or less in depth) ephemeral channel that carries water only during and for a few minutes after rainfall. Rills can be obliterated with conventional farm tillage implements.

Rock Land- Rock land consists of areas where rock or stones larger than three (3) feet on any plane occupy more than fifty (50) percent of the surface of that area. Where rock occupies from fifteen (15) to fifty (50) percent of and area, that area shall be classified as, a complex of the named soil and rock outcrops. Where rock or stones larger than three (3) feet on any plane occupy less than fifteen (15) percent of an area, the rock or stone shall be treated as an: inclusion and located on the soil map with the appropriate spot symbol, and noted: in the soil notes.

Rock, Shallow – any occurrence of rock at a depth that prohibits installation of an SSDS or that compromises the buffer (distance between disposal media and rock) required by statute/regulation. Shallow rock shall be treated as an inclusion and located on the soil map with the appropriate spot symbol and noted in the soil notes.

S

Sand - As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Saprolite - A soft, earthy, thoroughly decomposed rock formed in place commonly by chemical weathering of igneous and metamorphic rocks. It often forms a thick (as much as 100 m) layer or cover, especially in a humid and tropical or sub-tropical climate: The color is commonly some color of red or brown but colors may range through most of the Munsell colors.

Series, Soil - A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Silt - as soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sink means a closed depression in an area of karst topography, that is formed either by the solution of the surficial limestone or by the collapse of underlying caves. Its form varies from basin-like to funnel shaped and its size varies from only a few feet

across to several hundred feet across. The bottom of a sink most commonly consists of soil formed of materials, which rolled or washed from the surrounding area, and has slopes, which are generally, nearly level to undulating.

Sinkhole throat – an opening within a closed depression that allows for the passage of water from the surface to the subsurface.

Skeletan- a cutan composed of skeleton grains.

Slope or Grade means the rate of fall or rise of a pipeline or the ground surface in reference to the horizontal plane.

Slickensides - Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Soil- A natural body comprised of solids (minerals and organic matter), liquid and gases that occur on the land surface, occupies space and is characterized by one or both of the following: horizons or layers that are distinguishable from the initial material as a result of additions, losses, transfers and transformation of energy and matter or the ability to support rooted plants in a natural environment.

Soil Absorption Rate means the rate, in minutes per inch, that clean water is absorbed by or drains through a soil during least favorable climatic conditions when the soils are at or near field capacity. Estimated absorption rates are established in Appendix 1 for soil series and phases of soil series that have been recognized in Tennessee. For soil series and phases that have been recognized but not listed in Appendix 1 the Department shall establish the rate. Estimated soil absorption rates for variants of soil series and miscellaneous land types may established by an approved soil consultant; however, those rates may be established by the Department.

Soil Association - A group of defined and named taxonomic soil units occurring together in an individual and characteristic pattern over a geographic region, comparable to plant associations in many ways.

Soil Classification (Soil Taxonomy) the systematic arrangement of soils into groups or categories on the basis of their characteristics.

Order- The category at the highest level of generalization in the soil classification system. The properties selected to distinguish the orders are reflections of the degree of horizon development and the kinds of horizons present. The 12 soil orders in the U.S. system of soil taxonomy are as follows:

Aridisols- Mineral soils that have and acidic moisture regime, an ochric epipedon, and other pedogenic horizons but no oxic horizon.

Alfisols- Mineral soils that have umbric or ochric epipedon, argillic horizons, and that hold water at <1.5 MPa tension during at least 90 days when the soil is warm enough for plants to grow outdoors. Alfisols have mean annual soil temperatures of <8 degrees Celsius or a base saturation in the lower part of the argillic horizon of 35% or more when measured at pH 8.2

Entisols- Mineral soils that have no distinct subsurface diagnostic horizons within 1 m of the soil surface

Andisols- Mineral soils that are dominated by andic soil properties in 60 percent or more of their thickness.

Gelisols- Soils that have permafrost within the upper 1 m, or upper 2 m if cryoturbation is also present. They may have an ochric, histic, mollic, or other epipedon.

Histosols- Organic soils that have organic soil materials in more than half of the upper 80 cm, or that are of any thickness if overlying rock or fragmental materials that have interstices filled with organic soil materials.

Inceptisols- Mineral soils that have one or more pedogenic horizons in which mineral materials other than carbonates or amorphous silica have been altered or removed but not accumulated to a significant degree. Under certain conditions, Inceptisols may have an ochric, umbric, histic, plaggen, or mollic epipedon. Water is available to plants more than half of the year or more than 90 consecutive days during a warm season.

Mollisols- Mineral soils that have a mollic epipedon overlying mineral material with a base saturation of 50% or more when measured a pH 7. Mollisols may have an argillic, natric, albic, cambic, gypsic, calcic, or petro calcic horizon, a histic epipedon, or a duripan, but not an oxic or spodic horizon.

Oxisols- Mineral soils that have an oxic horizon within 2 m of the surface or plinthite as a continuous phase within 30 cm of the surface, and that do not have a spodic or argillic horizon above the oxic horizon.

Spodosols- Mineral soils that have a spodic horizon or a placic horizon that overlies a fragipan.

Ultisols-Mineral soils that have an argillic horizon with a base saturation of <35% when measured a pH of 8.2 Ultisols have a mean annual soil temperature of> 8 degrees Celsius or higher.

Vertisols- Mineral soils that have 30% or more clay, deep wide cracks when dry, and gilgai micro relief, intersecting slickensides, or wedge-shaped structural aggregates tilted at an angle from the horizon.

Suborder- This category narrows the ranges in soil moisture and temperature regimes, kinds of horizons, and composition, according to which of these is most important.

Great Group- the classes in this category contain soils that have the same kind of horizons in the same sequence and have similar moisture and temperature regimes.

Subgroup- The great groups are subdivided into central concept subgroups that show the central properties of the great group, intergrade subgroups that show properties of more than one great group, and other subgroups for soils with atypical properties that are not characteristic of any great group.

Family- Families are defined largely on the basis of physical and mineralogical properties of importance to plan growth.

Series- The soil series is a subdivision of a family and consists of soils that are similar in all major profile characteristics.

Soil Collapse (soil pipe) - a feature (roughly circular) formed when soil collapses into an underlying void. Typical in karst areas where water table fluctuations involving the soil/bedrock interface mine soil from the base of the soil profile. When the void becomes too large to support the overburden of soil, the ground surface will collapse into the void.

Soil Complex- A mapping unit used in detailed soil surveys where two or more defined taxonomic units are so intimately intermixed geographically that it is undesirable or impractical, because of the scale being used, to separate them. A more intimate mixing of smaller areas of individual taxonomic units than that described under soil association.

Soil Consistence- The combination of properties of soil material that determine its resistance to crushing and its ability to be molded or changed in shape. Such terms as loose, friable, firm, soft, plastic, and sticky describe soil consistence.

Soil Evaluation means the systematic examination of soils in the field and/or in laboratories, their description and classification, the mapping of kinds of soils or miscellaneous areas showing the distribution of soils in relation to the physical, cultural and special features of the earth's surface and the interpretation of the soils and site characteristics for their suitability for subsurface sewage disposal or to determine if the areas are eligible for percolation tests. The mapping is either general, high intensity or extra high intensity.

Soil Hydrology – the science dealing with the distribution and movement of the soil solution in the soil profile

Soil Observation – each individual auger boring or pit utilized to see and identify the soil characteristics at one location.

Soil Map means a map showing the size, shape, and distribution of the various kinds of soil in relation to other physical and cultural features on the earth's surface. There are three (3) kinds of soil maps. They are **general, high intensity and extra high intensity.** They are defined as follows:

(a) **General -** A general is a second order survey as defined in the Soil Survey Manual. United States Department of Agriculture, October 1993. These surveys are made for intensive land use that require detailed information. Map units shall be named at a categorical level above the soil series. Miscellaneous land types or interpretative groupings of soils such as those in which percolation tests are allowed for subsurface sewage disposal site evaluation shall be delineated. Map scale shall be one (1) inch equals one hundred (100) feet. Minimum size map unit delineations shall be twenty-five hundred (2,500) square feet. The mapping legend shall be provided by the Department.

(b) **High Intensity** - A first order survey as defined in the Soil Survey Manual, United States Department of Agriculture, October 1993. These surveys are made for very intensive land use that require very detailed soils information that require very precise knowledge of soils and their variability such as individual building sites. Field procedures require observation of soil boundaries throughout their length. Map units are mostly soil series, phases of soil series with some complexes and miscellaneous land areas. Some map units named at categorical level above the series are allowed. Map scale shall be one (1) inch equals one hundred (100) feet. Minimum size delineation shall be six hundred twenty-five (625) square feet.

(**c) Extra High Intensity** - A map that is the same as a high intensity soil map except the scale may be one (1) inch equals one hundred (100) feet or one (1) inch equals fifty (50) feet. The minimum size delineation shall be one hundred (100) square feet. These maps have more cartographic detail than high intensity maps.

Soil Map Unit means an abstract model of a soil taxonomic unit or miscellaneous land type that has a set of distinguishing soil characteristics that set it apart from all other soil map units.

Soil Map Unit Delineation means an area on a soil map that represents a kind of soil or miscellaneous land type that occupies an area on the earth's surface. There may be several map unit delineations of one soil map unit.

Soil Series means a group of very similar soils that have one or more soil characteristics that distinguishes that soil from all other soil series. As used in these Regulations, a soil series is one that has been recognized by the Natural Resource Conservation Service in Tennessee.

Soil Structure - The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are,

Platy - (laminated)
Prismatic- (vertical axis of aggregates longer than horizontal)
Columnar- (prisms with rounded tops)
Blocky- (angular or sub angular)
Granular
Structureless- either
Single grained (each grain by itself, as in dune sand)
Massive (the particles adhering without any regular cleavage, as in many hardpans)

Soil Taxadjunct means soil that has one or more distinguishing soil characteristics that prevents that soil from being classified in any soil series that has been recognized by the National Cooperative Soil Survey in Tennessee. A taxadjunct to a soil series does not differ enough to require different use and management or to expect different behavior from the name soil to which it is adjunct.

Soil Taxonomy – A basic system of soil classification for making and interpreting soil surveys. United States Department of Agriculture, Natural Resources Conservation Service, Keys to Soil Taxonomy, Eighth Edition, 1998.

Soil Temperature Classes- a criterion used to differentiate soil in U.S. Soil Taxonomy, mainly at the family level. Classes are based on mean annual soil temperature and on differences between summer and winter temperatures at a depth of 50 cm.

Soil Textural Class- A grouping of soil textural units based on the relative proportions of the various soils separates (sand, silt, and clay). These textural classes, listed from the coarsest to the finest in texture are: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. There are several subclasses of the sand, loamy, sand, and sandy loam classes based on the dominant particle size of the sand fraction (e.g., loamy fine sand, coarse sandy loam).

Soil Texture- The relative proportions of the various soil separates in a soil.

Soil Variant means a soil that has one or more distinguishing soil characteristics and soil properties that prevent that soil from being classified in any soil series that has been recognized by the National Cooperative Soil Survey in Tennessee. A soil

variant requires use and management significantly different from the soil from which the variant is named. Also, behavior different from the soil series for which the variant is named can be expected.

Solum - (p. sola) The upper and most weathered part of the soil profile: the A, E, and B-horizons. A set of horizons that are related through the same cycle of pedogenic processes.

Spring means a point where water naturally issues from the ground surface.

SSDS – Subsurface Sewage Disposal System means a system, other than a public or community system, which receives sewage. Included within the scope of this definition are: septic tank absorption systems, privies, chemical toilets, and other similar systems. However, a subsurface sewage disposal system does not include a sewerage system regulated under T.C.A. Sections 68-221-101 et. seq. and 68-3-101 et. seq.

Stream Order (geological) – first order streams are the smallest unbranched tributaries; second order streams are initiated by the confluence of two first order streams; third order streams are initiated by the confluence of two second order streams; etc.

Subdivision means any tract or parcel of land divided into two (2) or more lots, sites or other division for the purpose of immediate or future building of dwellings, buildings, or other mobile or permanent structures where subsurface sewage disposal systems are to be used. Subdivision does not include a division of any tract or parcel of land into two (2) or more tracts or parcels when such parts are five (5) acres or larger in size.

Subsoil- Technically, the B-horizon; roughly the part of the solum below plow depth.

Surface Layer - The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer" or the "Ap horizon".

Surface Runoff – water that travels over the soil or rock surface to the nearest surface stream.

Swelling means a condition caused by the intrusion of water into the individual clay particles.

T

Taxadjuncts - Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

TDEC - Tennessee Department of Environment and Conservation.

Terrace (geology) - An old alluvial plain, ordinarily flat, or undulating, bordering a river, a lake, or the sea.

Texture, Soil- Relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles are: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay, loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse" "fine" or "very fine".

Toe Slope - The outermost generally concaved inclined surface at the base of a hill; part of a foot slope. Generally has lower slope gradient than the other portion of a foot slope.

Topographic Map means a map showing existing physical features, with contour lines at sufficient intervals to permit determination of proposed grades and drainage.

Type, Soil - A member of a soil series. It differs from other members (types) of the series by the texture of the surface layer.

U

Undifferentiated Soil Groups - Two or more taxonomic units, which do not occur in regular geographic association, mapped as a single unit.

Upland (geology) - Land at a higher elevation, in general than the alluvial plain or stream terrace; land above the lowlands along streams.

V

V-ditch – a broad trench, similar to an agricultural grassed waterway, with a V-shaped cross-section.

Value, Color - The relative lightness or intensity of color and approximately a function of the total amount of light. One of the three variables of color. See Munsell color system, hue, chroma, and value

Variegation - Refers to patterns of contrasting colors assumed to be inherited from

the parent material rather than to be the result of poor drainage (see Mottling, Soil).

Vicinity Map means a map, which indicates the region near or about a place and the proximity to prominent and established landmarks.

W

Water Table means that level below which the soil or rock is saturated with water.

Water Table, Perched - The water table of a saturated layer of soil, which is separated from an underlying saturated layer by an unsaturated layer.

Water Bodies- Include but are not limited to ponds, lakes, streams, springs and wells. They shall be located on all soil maps with the appropriate symbol.

Wetland – those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

1.0 Soils Consultant Approval

Section 1200-1-6-.17 of the Tennessee Department of Environment and Conservation (Department), Division of Groundwater Protection's (Division) Regulations to Govern Subsurface Sewage Disposal Systems (Regulations), identifies the requirements for approved soils consultants in the State of Tennessee.

Approved soils consultants are entitled to submit soil maps, soil evaluations, and site investigations in support of the statutory and regulatory objectives of the Division.

Approved soils consultants are also among those whose percolation test results are acceptable.

1.1 Education Requirements for Soils Consultant Approval

Graduation from an accredited college or university with a bachelor's degree in soil science, agronomy, and/or agriculture with emphasis in plant and soil science or agronomy; **or,** graduation from an accredited college or university with a minimum of thirty (30) quarter hours biological, physical and earth sciences and an additional twenty-two and one-half (22.5) quarter hours or equivalent semester hours in soil science is required.

Any course in an agronomy, plant and soil science or soil science department in which soil is a part of the course name shall be a creditable course. Also, a course in clay mineralogy shall be a creditable course even though it may be in another curriculum such as geology. Other geology courses shall not be substituted for courses in soils.

Experience shall not be substituted in lieu of educational requirements.

1.2 Experience Requirements for Soils Consultant Approval

A minimum of two (2) years full time or equivalent of soil evaluation experience in accordance with the United States Department of Agriculture system is required. Experience must include studies of soil physical characteristics, geology and soil relationships, soil-landscape relationships, soil identification, landscape features, mapping techniques, interpretive ranges, sewage systems, and soil improvement design variations.

The experience shall be full time or equivalent experience totaling four hundred eighty (480) days. There shall be no more than one (1) day credit gained in any one (1) calendar day. One day shall consist of seven and

one-half (7.5) hours. A calendar day shall be a 24-hour period that begins at 12:01 A.M. and expires at 12:00 P.M. on that day. Experience gained during or before educational requirements are met will be considered on a case-by-case basis, not to exceed one-fourth of the total experience requirement.

The experience shall be documented through a notarized affidavit by a soils consultant approved by the Division or by a NRCS soil scientist who is GS-11 grade or higher. In the notarized affidavit the soils consultant who provided the training shall attest to the fact that the candidate for approval was trained under the guidelines established by the Soils Handbook of Tennessee (Soils Handbook). However, completion of a training plan based on the Soils Handbook may not be required for NRCS soil scientists who were a trained by the NRCS under the supervision of a soil scientist in grade level GS-11 or higher, employed by the NRCS. An affidavit, along with documentation of type of training, signed by the NRCS soil scientist who supervised the soils consultant candidate shall be submitted for consideration.

1.3 Soils Consultant Testing Procedure

The testing procedure for soils consultants consists of three (3) phases that shall be administered in sequence, beginning with Phase 1. Phase 1 is the written examination; Phase 2 is the field soil-mapping test; and Phase 3 is the satisfactory completion of five (5) high intensity soil maps. Also, before a soils consultant is included on the approved list and before any of the soils consultant's maps are used in support of subdivision approval or permit issuance the soils consultant must comply with T.C.A 68-221-409(b) (bonding).

Prior to beginning Phase 1 of the testing procedure, the soils consultant candidate must provide appropriate documentation attesting to education and experience achievements to the Division (academic transcripts, affidavits…). This information is to be submitted to the State Soils Consultant Regional Supervisor (SSCRS).

1.3.1 Phase 1 – Written Exam

Phase 1 of the testing procedure is a written exam. All candidates to become approved soils consultants shall be required to pass a written examination. The written examination is to demonstrate that the candidate has mastered the Soil Taxonomy and some fundamental principles of soil science (pedology), geology and geomorphology. Also, the written test shall demonstrate that the candidate has adequate knowledge of the Regulations and the Soils Handbook as they apply to soil mapping and soil map

interpretations. A test score of eighty (80) percent correct is required.

Notification of test score will be provided to the Central Office by the SSCRS. The Division's Central Office will provide notification of test score to the soils consultant.

1.3.2 Phase 2 – Field-Mapping Test (also used for Section 5.0)

Phase 2 of the testing procedure is a field-mapping test. The candidate must pass a field soil-mapping test to demonstrate mastery in soil classification, soil mapping, and soil map interpretations as they apply to subsurface sewage disposal. Also, Phase 2 shall demonstrate that the candidate has adequate cartographic skills. A score of eighty (80) % or more is required. Upon the successful completion of the field mapping test the candidate receives interim soils consultant approval to complete high intensity soil maps.

The field-mapping test shall be compared to a high intensity soil map completed by an approved Soils Consultant 2, SSCRS or Soils Consultant Manager employed by the Division as a soils consultant. The following criteria as outlined in Table 1.1 shall determine the score of Phase 2 of the testing procedure:

A. Soil Classification

A1. Accordance with Soil Taxonomy and Official Soil Series Descriptions

Soil shall be classified according to the Soil Taxonomy, the Official Soil Series Description (OSD), and the Regulations. However, where a soil is misclassified but that error does not affect the use and management of that soil or the design of a subsurface sewage disposal system (SSDS), that error is not critical; and, typically, no points shall be deducted from the test score.

Where a soil is misclassified and that error affects the use and management of that soil or the design of a SSDS, that error is critical and up to twenty-five (25) points shall be deducted from the test score.

A2. Soil Absorption Rate in Concordance with Appendix I

The soil absorption rates for soil series shall be those listed in Appendix I of the Regulations except for those conditions that require less favorable rates based on Additional Site Requirements and Limitations for Subdivision Approval and Individual Lots and Issuance of Construction Permit (Rule 1200-1-6-.03) in the Regulations and Section 2.11 of The Soils Handbook.

Where a soil series is rated more favorable than the absorption rate established in Appendix I of the Regulations, up to twenty-five (25) points shall be deducted from the test score.

A3. Appropriate Depth Associated with Absorption Rate

Where soil absorption rates for soil series or phases of soil series are given to depths greater than the soil conditions warrant, up to twenty-five (25) points shall be deducted from the test score.

A4. >75 MPI Soils Identified Correctly

If the rate designated by the approved soils consultant is >75 MPI, no lesser rate will be considered accurate; also, if the soils consultant candidate designates a soil to be >75 MPI and the approved soils consultant rates the soil as 75 MPI or <75 MPI, the soils consultant candidate's designated rate will be considered inaccurate. Rating inaccuracies of the above-mentioned type will receive up to a twenty-five (25) point deduction.

A5. Appropriate Designation of Soil Improvement Practices

The need for soil improvement practices is determined on the site by an approved soils consultant. Where soil improvement practices are needed but not identified on a soil map, up to twenty-five (25) points shall be deducted from the test score. Where soil improvement practices are identified as requirements on the soil map but are not necessary, up to twenty-five (25) points shall be deducted from the test score.

B. Soil Map Unit Line Placement

Soil lines between similar soils (soils with similar physical and chemical characteristics) that have the same use and management

requirements, the same expected performance and the same estimated absorption rates need not be separated on the soil map. Line placement between these soils is not critical.

Soil line placement between dissimilar soils is critical. Dissimilar soils are soils that have one or more soil characteristics that are different from the adjacent soils. The difference in soil characteristics requires different use and management, or under the same management different results are nearly certain. Some examples are: soils that have different soil absorption rates, different physical or chemical soil characteristics, different depths to restrictive horizon, and soils that require different management practices.

Soil lines between dissimilar soils that are misplaced by twenty (20) feet or more are significant and each occurrence shall reduce the test score by up to twenty-five (25) points.

Soil lines that have been misplaced between dissimilar soils by more than ten (10) feet but less than twenty (20) feet shall result in a reduction of up to fifteen (15) points for each occurrence on the soil map.

Soil lines that have been misplaced by ten (10) feet or less shall result in no deductions from the score.

C. Significant Features

C1. All Identified

Where cut banks, drains, drainageways, gullies, streams, sinkholes, wells or other significant natural or constructed features are omitted up to twenty-five (25) points shall be deducted for each occurrence on the soil map. Features identified outside the mapped area, which affect the use of the mapped area, should also be located.

C2. Correctly Located

Where one or more of these natural or constructed landscape features is misplaced by more than ten (10) feet, up to twenty-five (25) points shall be deducted for each occurrence on each soil map.

Where one or more of these natural or constructed landscape features is misplaced by less than ten (10) feet, no deduction shall be made from the score.

D. Soil Notes

D1. Formatting and Legibility

Accurate soil notes that are specific, complete and legible are crucial to the use of a soil map. The tabular format presented in Section 3.5 is required on the soil map. Appendix B provides examples of notes compiled in the tabular format.

Where the soil notes are inaccurate, incomplete, illegible, or not in the proper format, up to twenty-five (25) points shall be deducted from the test score.

D2. Statement Omission

The statement "Any cutting, filling or compaction will void this soil map." and the statement that names the kind of soil map completed, the soils consultant who completed that soil map, and the date of completion is required. Where any of the required statements is omitted or is incomplete, up to twenty-five (25) points shall be deducted from the test score.

The following statements should also appear on the map:

"This soil map is to evaluate the site for a subsurface sewage disposal system only. This soil map complies with the standards established in the Regulations to Govern Subsurface Sewage Disposal Systems, the Soils Handbook, and the Soil Taxonomy. No other warranties are made or implied."

"Signature of Soils Consultant does not constitute approval of this map by the Division of Ground Water Protection."

D3. Inappropriate Statements

Where an inappropriate statement, especially statements that specify the design or installation of a SSDS, specify how the soil map may or may not be used, leaves any doubt about the accuracy of the soil map, or serves as a disclaimer to the accuracy of the map are used, twenty-five (25) points shall be deducted from the test score.

D4. Legend and Symbols

Both conventional and ad-hoc symbols that appear on a soil map shall be defined in a map symbol legend printed on the

front of each soil map. Where one or more of these symbols is omitted or is inaccurately shown in the legend, up to twenty-five (25) points shall be deducted from the test score. Appendix A provides an index of acceptable map symbols.

TABLE 1.1
FIELD MAPPING SCORING PROCEDURE

Primary Map Category	Primary Map Subcategory	Point Value
A. Soil Classification	A1. Accordance with Soil Taxonomy and Official Soil Series Descriptions	25
	A2. Absorption Rate in Concordance with Appendix I	
	A3. Appropriate Depth Associated with Absorption Rate	
	A4. >75 MPI Soils Identified Correctly	
	A5. Appropriate Designation of Soil Improvement Practices	
B. Soil Map Unit Line Placement		25
C. Significant Features	C1. All Identified	25
	C2. Correctly Located	
D. Soil Notes	D1. Formatting and Legibility	25
	D2. Statement Omission	
	D3. Inappropriate Statements	
	D4. Legend and Symbols	
Total Points		100

The field mapping test score shall be determined using the method outlined in Table 1.1 by SSCRS. A failing map score for the field-mapping test will be confirmed by a consensus of SSCRS.

The maximum number of points is one hundred (100), which is a perfect score. Each error or omission will result in a deduction of all or a portion of the points assigned to that category. A score of eighty (80) % is considered satisfactory.

The portion of points deducted from the total points for a category will be determined by the severity of the error. Minor errors or omissions shall be errors or omissions that: would not change whether a site was permitted or not; and, would not be expected to cause system failure due to undersizing. These types of errors or omissions (individually) would not typically result in a total loss of points for that category. However, multiple minor errors or omissions in a category may result in the loss of all points associated with a category. Minor errors or omissions are not limited to the above-listed examples. Major errors or omissions that would typically result in a total loss of points for that category, and result in a failing score for the map, would be those errors or omissions that: caused a system to be undersized to the degree that failure would be expected; caused a system to permitted in unsuitable soil; presented a suitable soil as unsuitable; did not adequately identify soil improvement practices; and, misuse of variant label. Major errors or omissions are not limited to the above-listed examples.

After the field-mapping test has been successfully completed, the candidate for approval shall become a tentatively-approved soils consultant, approved to complete high intensity soil maps only. The Division's Central Office will provide notification of tentatively-approved status to the soils consultant.

1.3.3 Phase 3 – Five High-Intensity Soil Maps

Phase 3 of the testing procedure consists of successfully completing the first five (5) high intensity soil maps. The tentatively-approved soils consultant shall submit the first five high intensity soil maps for evaluation by an approved soils consultant employed by the Division.

Each of the first five (5) high intensity soil maps shall be evaluated using the same criteria and values used for the soil mapping field test. A score of eighty (80) percent is required on each of the maps. Each of the first five soil maps shall be submitted to the Division as soon as it is completed. Each of the five (5) high intensity soil maps shall be made to comply with the criteria set forth in the most current edition of the Soils Handbook, the Regulations, and the Soil Taxonomy. If any of the five maps are reviewed by staff soil consultants notification must be made to the appropriate SSCRS.

After successful completion of all phases of the approval process the tentatively-approved soils consultant becomes a soils consultant approved to make general and high intensity soil maps. Notification of approved status will be made to the Division's Central Office by the SSCRS. The Division's Central Office will provide notification of approved status to

the soils consultant. Also, before a soils consultant is included on the approved list and before any of the soils consultant's maps are used in support of subdivision approval or permit issuance the soils consultant must comply with T.C.A 68-221-409(b) (bonding).

1.4 Results of Failing Examination

The Regulations in Rule 1200-1-6-.17(1)(f) state: "If the candidate fails the written examination, the field test or any of the first five (5) soil maps, the testing procedure may begin again after a six (6) month period. The second time, if the candidate fails the written test, the field mapping test or any of the first five (5) high intensity soil maps, the testing procedure may begin after a twelve (12) month waiting period. The testing procedure may be repeated only one time."

1.5 Extra High Intensity Soil Maps

Extra high intensity soil maps are accepted by the Division by those approved soils consultants who have demonstrated that they have the knowledge and skills to complete these soil maps.

The Regulations state under Rule 1200-1-6-.17(1)(g), "After a period of one (1) year and the completion of a minimum of twenty-five (25) high intensity soil maps with a total of one hundred (100) acres, an approved soils consultant who has not been reprimanded or suspended may apply to become approved to make all intensity soil maps." This application should be made to the SSCRS.

The one (1) year period shall consist of three hundred sixty-five (365) consecutive days. The one (1) year period shall begin on the date after the candidate officially became an approved soils consultant.

The twenty-five (25) high intensity soil maps shall be soil maps of any size that have been completed without errors or omissions (but that total at least 100 acres). The five (5) high intensity soil maps completed, as part of the soils consultant's testing procedure, shall be excluded.

After the twenty-five (25) high intensity soil maps have been completed, the candidate shall be required to participate in a training workshop for completing extra high intensity soil maps.

After completion of the above-listed requirements, the candidate shall receive tentative approval to complete all intensity soil maps.

Each of the first five (5) extra high intensity soil maps shall be submitted to the SSCRS for evaluation. Each of the five (5) extra high intensity soil maps shall have the following statement in capital letters printed on it:

EXTRA HIGH INTENSITY SOIL MAP COMPLETED BY
(SIGNATURE)
SOILS CONSULTANT

TENTATIVELY APPROVED TO COMPLETE ALL INTENSITY SOIL MAPS

The five extra high intensity soil maps shall be evaluated by the appropriate SSCRS or the soils consultant manager. The criteria to evaluate the high intensity soil maps shall be used; keeping in mind the increased degree of accuracy associated with extra-high intensity maps as defined by the Regulations (1200-1-6-.01).

After the first five (5) extra high intensity soil maps have been evaluated and accepted by the Division, that candidate shall be approved to make all intensity soil maps. The Division's Central Office will provide notification of approved status to the soils consultant.

2.0 Soil Classification – Soil Mapping And Soil Interpretations

Soil mapping consists of (1) accurately classifying the soil or miscellaneous land type, (2) accurately delineating the boundaries of the soil or miscellaneous land type on a suitable base map, and (3) accurately predicting the performance of each kind of soil for subsurface sewage disposal purposes.

2.1 Units Of Soil Classification

Soils are classified as soil series, phases of soil series, taxadjuncts to soil series or variants of soil series.

Soil series is the lowest category in the Soil Taxonomy. Each soil series has a set of physical and chemical characteristics specific to that soil series, and those characteristics set that series apart from all other soil series. Each soil series named must be within the range of soil characteristics that have been established for that soil series.

Phases of soil series may be established to more accurately predict the behavior of that soil under a specified use and management. (Examples are slope classes, depths to rock, fragipan, etc.)

Variants of soil series are used to identify soils for which there are no established soil series, and for established soil series that have not been recognized by the National Cooperative Soil Survey (NCSS) in Tennessee. Variants have not been recognized by the NCSS since 1988. In this Soils Handbook, the definition of a variant differs slightly from the definition used by the NCSS.

A soil variant is a soil that has one or more characteristics that prevents that soil from being classified in any soil series recognized by the NCSS in Tennessee. Some examples that justify the use of a variant are: depth to rock where the depth to rock is outside the range in characteristics (less depth or more depth than allowed) of the named series; depth to a fragipan where the depth is more than 40 inches; or difference in soil texture that would change the classification of the named series, and the use, management and interpretations of that soil.

Soil variants are rare. The use of a soil variant requires documentation that contains, but is not limited to, a soil profile description that describes the soil color (as compared to the Munsell soil color chart), including mottles; soil texture; soil structure; clay films; redoxomorphic features, or any other soil characteristic important to the classification of that soil. The use of a soil variant will delay the evaluation of that site, because an on-site evaluation by a state-employed soils consultant is required.

Soil taxadjuncts to a soil series consist of soils that have one or more soil characteristics that prevents that soil from being classified in any recognized soil series, but does not change the use and management or predicted behavior of that soil. One example of soil taxadjuncts is some soil colors that vary one or two color chips on the Munsell system from the range allowed for the named soil. Other examples are a soil that varies in soil texture enough to change the classification but is not significant to the use and management or predicted behavior of that soil (e.g. fine loamy versus fine silty), or depth to a fragipan where the depth is outside the range of characteristics for that soil series but is less than 40 inches.

Miscellaneous land types consist of areas of non-soil, and areas of soil that lack diagnostic horizons necessary to classify that soil. Non-soil miscellaneous land types consist of, but are not limited to, consolidated rock, water bodies, paved areas, etc. Miscellaneous land types of soil consist of gullied land, graded land, filled land, etc. that can be classified only in higher categories in the Soil Taxonomy.

2.2 Kinds of Soil Maps

2.2.1 General Soil Maps

A general soil map is a Second Order survey as defined in the Soil Survey Manual, United States Department of Agriculture, October 1993. These surveys are made for intensive land use that requires detailed information. Field procedures permit plotting of soil boundaries by observations and interpretation of other available data. Boundaries are verified at closely spaced intervals and the soils in each delineation are identified by transecting or traversing. Map units shall be named at a categorical level above the series, miscellaneous areas, or interpretive groups of soils such as those in which percolation tests are allowed or not allowed. Map scale shall be one (1) inch equals one hundred (100) feet. The minimum size delineation shall be two thousand five hundred (2500) square feet.

This kind of soil map is necessary to meet the requirements of T.C.A. 68-221-403(c)(7) effective July 1, 1990. The only purpose of these soil maps is to determine whether or not the soils on a site meet the requirements to be evaluated for subsurface sewage disposal systems by utilizing percolation tests.

Regulation 1200-1-6-.02(3)(b) sets forth conditions under which percolation tests may be conducted. Criteria to use for evaluating soils or sites for suitability for percolation shall be depth to rock,

slope and wetness or water problems. Soils shall not qualify for percolation tests if they meet one or more of the following:

1. Soils that are classified in The Soil Taxonomy suborders that have an aquic moisture regime.
2. Soils that are classified in The Soil Taxonomy great group that have fragipan properties.
3. Soils that are classified in The Soil Taxonomy subgroups that have the modifier aquic, glossic, fragic, or vertic in the name.
4. Soils that have insufficient depth to rock.
5. Slopes of more than 30 percent shall be considered unsuitable unless determined to be suitable following a special investigation by an approved soils consultant and an environmental specialist. Slopes exceeding 50 percent shall be considered unsuitable.

The requirements of general soil maps were established by a memorandum issued by the Division of Ground Water Protection on July 18, 1990 in response to Tennessee Code Annotated 68-221-403. This memorandum specified the mapping legend that is to be used. General soil maps shall be completed according to the following specifications:

(1) A closed legend shall be used. Only the mapping units and symbols in the established legend are allowed. Any other mapping units must have prior approval from the Division's Central Office before use.
(2) All requirements applicable to base maps for High Intensity Soil Maps apply.
(3) All requirements relative to map finishing and completion for a high intensity soil map shall apply except as noted in the memo.
(4) There shall be no color coding.
(5) No soil names (series, types, phases or miscellaneous land types) shall be on the map or in the legend.
(6) There shall be no soil notes on the map or attached to the map. Only the legend with a definitive name for the mapping symbol shall be on the map. This can be a copy of the established legend, but preferably is a legend with only the applicable mapping units for that particular map.
(7) No recommendations relative to soil improvement practices shall be made.
(8) All features such as roads, wells, streams, sinks, springs, rock outcrops, escarpments, gullies, buildings and others shall be accurately located on the general soil map.

(9) All areas with limestone bedrock at or near the surface shall be considered karst.

MAPPING LEGEND FOR GENERAL SOIL MAPS

SYMBOL	NAME
KP	Karst, percable, well drained, 36 inches or more to hard rock, 0 to 30 percent slopes
KP_R	Karst, percable, well drained, 24 to 36 inches to hard rock, 0 to 30 percent slopes
P	Non-karst, percable, well drained, 30 inches or more to hard rock, 0 to 30 percent slopes
P_R	Non-karst, percable, well drained, 24 to 30 inches to hard rock, 0-30 percent slopes
NP_S	Karst and non-karst, non-percable, more than 50 percent slopes
NP_W	Karst and non-karst, non-percable, water problem (wetness), 0 to 30 percent slopes
NP_{RI}	Karst and non-karst, non-percable, due to less than 24 inches to hard rock, 0 to 30 percent slopes
SI_S	Karst and non-karst, 30 to 50 percent slopes, requires special investigation.

If a mapping unit has more than one limitation, then more than one subscript (S- slope, W- water problem, R – depth to rock) should be used. For example, if NP has limitations of wetness and insufficient depth to rock, then both should be noted $NP_{W,RI}$.

2.2.2 High Intensity Soil Maps

A high intensity soil map is a First Order survey as defined in the Soil Survey Manual, United States Department of Agriculture, October 1993. These surveys are made for very intensive land use that require very detailed soils information that require very precise knowledge of soils and their variability such as individual building sites. Field procedures require observation of soil boundaries throughout their length. Map units are mostly soil series, phases of soil series with some complexes and miscellaneous land areas. Some map units named at a categorical level above the series are allowed. Map scale shall be one (1) inch equals one hundred (100) feet with a minimum size delineation of six hundred and twenty-five (625) square feet.

High intensity soil maps may be on a 100-foot master grid system with surveyed control stakes numbered at not more than 500-foot intervals with the location of same shown on the plat. The intermediate grid stakes may be set by rough chaining or other methods to a lesser degree of accuracy; however, intermediate stakes shall be within two (2) feet of the distance shown.

The ratio of precision of the unadjusted survey shall be a minimum of 1:1000. The plat shall show: (1) the seal and signature of the surveyor and (2) a bar scale. Excessive vegetative growth such as weeds, vines, briars or other growth shall be removed to provide access to the area to be soil mapped. Wooded areas shall have adequately cut and flagged lines to identify the lot lines.

High intensity soil maps may also be based on a staked lot method. Staked lots must have a numbered surveyed stake at each corner. The ratio of precision of the unadjusted survey shall be a minimum of 1:1000. The plat shall show the seal and signature of the surveyor and a bar scale. Intermediate ground control stakes shall be numbered and set in areas where lot corners are not visible from any point on the lot. The intermediate stakes must be set no more than 200 feet apart, and said intermediate stakes may be set by rough chaining or other methods to a lesser degree of accuracy; however, said stakes shall be within two (2) feet of the distance shown on the plat. The removal of vegetative growth such as weeds, vines and briars to permit access to all parts of the property may be required. In wooded areas cut/flagged lines shall be in place at the time the soil mapping is done.

2.2.3 Extra High Intensity Soil Maps

An extra-high intensity soil map shall be the same as a high intensity map except the map scale may be one (1) inch equals one hundred (100) feet or one (1) inch equals fifty (50) feet. Also, the minimum size delineation shall be one hundred (100) square feet. These maps show more taxonomic detail and more cartographic detail than high intensity soil maps. A base map with grid points at 50-foot intervals is required on most sites. However, in some cases (disturbed, fill…) a base map with grid points at 25-foot intervals may be required.

These soil maps are made to provide very detailed soil information that is required to make land use decisions on small areas where soils and landscapes are variable and complicated. They may be most useful to provide soils information about soils that occur in very complicated patterns on very complex landscapes.

2.3 Soil Map Unit Design

Soil map units represent a collection of soils that have similar soil characteristics and similar soil properties. Soils in a soil map unit must have similar and predictable response to a specified use and management. A soil map unit delineation is one specific delineated area on a soil map that represents one specific area of similar soils on the earth's surface.

2.4 Soil Map Unit Names

Soil series and phases of soil series are the most common and useful kind of soil map units used because:

(1) They have a strong scientific bias;
(2) Many soil characteristics, soil properties, and soil qualities can be expressed with a single name;
(3) The physical and chemical properties and performance of similar soils can be extrapolated from laboratory data and the results of on-site experiments from similar soils.
(4) The behavior of a soil can be predicted from extrapolations of data collected by observations and measurements taken from similar soils.

Soil map unit names should be determined in consideration of the entire upper 48 inches of the soil profile.

Map units consisting of 0.1 % to 10 % rock outcrop can be named either as "Rocky" or "Very Rocky" phases or as complexes or associations of soil and rock outcrop. Commonly, map units with less than 3 % rock outcrop are named "Rocky" and those with 3 % to 10 % rock outcrop are named "Very Rocky". Map units consisting of 11 % or more rock outcrop are normally named complexes or associations of soil and rock outcrop. These map units cannot be used for sewage disposal systems.

Where soil variants not previously approved by the Division are proposed, a brief soil profile description (a minimum of matrix color, redox depletions, redox accumulations, texture, structure, consistence and all other important soil characteristics) shall be attached to the soil map. The probable classification of the variant (subgroup and family) shall be provided, along with the soil profile description. Use of variants will necessitate review by SSCRS.

The use of soil variants to vary the estimated absorption rate of soil series is not acceptable.

Miscellaneous land types include, but are not limited to, filled land, graded land, gullied land, and wetlands.

Filled land consists of areas to which more than 24 inches of soil, rock or debris have been added. Where less than 24 inches of soil, rock or debris have been added, the buried soil shall be classified and evaluated to a depth of 48 inches from the original surface, or to rock (lithic contact).

Graded land consists of areas that have been graded or otherwise manipulated to the extent that the remaining soil cannot be classified in any soil series. Where grading has been less severe, and diagnostic horizons remain, the remaining soil shall be classified as a graded phase of the appropriate soil series.

Gullied land consists of areas where gullies more than one (1) foot in depth occupy more than fifty (50) percent of the area. Where gullies more than one (1) foot in depth occupy from fifteen (15) percent to fifty (50) percent of an area, that area shall be classified as a complex of the remaining named soil series and gullied land. Boundaries of "Gullied Land" soil map units should not be positioned to encompass the necessary buffer for sewage disposal purposes. The boundary should be positioned at the edge of the feature closest to the edge of the "Gullied Land" soil map unit. Further investigations with an extra high intensity soil map may or may not reveal areas, within these units, of suitable soils for subsurface sewage disposal systems.

Wetlands are defined as those areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

2.5 Kinds of Soil Map Units

Single taxon soil map units (consociations) are soil map units in which each soil map unit delineation is comprised of eighty-five (85) percent or more of the named soil. No areas of the fifteen (15) percent inclusions shall exceed the acceptable maximum size for each kind of soil map. However, shallow rock inclusions should represent no more than 10 percent of the soil map unit. Shallow rock inclusions are defined as those areas where depth to rock is shallower than the depth to rock identified on the soil map for that area. These areas, if encountered during construction would affect system construction (less than adequate buffer). Dissimilar soil inclusions shall not exceed 2500 square feet on general soil maps, 625 square feet on high intensity soil maps and 100 square feet on extra high intensity soil maps.

Inclusions of similar soils (soils with the same estimated absorption rates and the same management requirements) need not be mentioned in the soil notes.

Where dissimilar soils occupy more than fifteen (15) percent of a map unit, the entire area shall be classified and delineated as a soil complex. The most limiting soil in a complex shall determine the use and management of that soil map unit. On many landscapes, dissimilar soils occur together in areas larger than the acceptable sizes or occupy more total area than is acceptable for inclusions, but are too small to be used separately. Generally there is no need to separate these soils on a soil map. On these landscapes, soil complexes may be used to depict these areas on a soil map. The soil interpretations (absorption rates, etc.) of the most limiting soil in the complex shall apply.

2.6 Slope Classes

Slope classes are different for each kind of soil map because of the different amount of detail required for each kind of soil map.

Slope classes for general soil maps are established in the legend. The slope classes are: 0 to 30 percent, 30 to 50 percent, and greater than 50 percent.

Where slopes are between 30 and 50 percent a special investigation shall be conducted to evaluate those soils and/or to determine whether the site may be evaluated using percolation tests.

Slope classes for high intensity soil maps shall be adequate to evaluate sites for all conventional subsurface sewage disposal systems and some other systems, and to design such systems. These slope classes should provide adequate data to design soil and site improvement practices. The slope classes for high intensity soil maps are:

0 to 5 percent
5 to 15 percent
15 to 30 percent
30 to 50 percent
greater than 50 percent.

Where slope classes of 0 to 3 percent and 3 to 5 percent are useful to design subsurface drains, those classes should be used. On undulating ridgetops where the slopes are complex a 2%-8% slope class may be useful.

Where slopes are extremely complex and are mostly steep or very steep, slope classes of 0 to 30 percent, and greater than 50 percent may be used.

Slope classes for extra high intensity soil maps shall be those slope classes required to design all conventional subsurface sewage disposal systems, all alternative subsurface sewage disposal systems, and experimental systems. The slope classes for extra high intensity soil maps are:

0 to 3 percent
3 to 6 percent
6 to 12 percent
12 to 30 percent
30 to 50 percent
greater than 50 percent

Slope classes shall distinguish the main parts of simple hilly landscapes by delineating the ridge (hill) tops, the hillsides (back slopes) and valley floors (toe/foot slopes). Generally, soil differences will separate these main parts of most landscapes.

2.7 Drain and Cutbank Identification

Drainageways have no visible or defined channel and, as a result, it is usually hard to determine the point where surface water starts to accumulate or collect. A drainageway landscape is usually concave or u-shape and does not physically limit the installation of septic system field lines. Surface water spreads out and dissipates across the surrounding landscape. Due to the lack of a channel, these drains may flood the surrounding area and some may flood often. Potential for flooding is directly associated with the drainageway catchment area and volume and intensity of rainfall. No symbol is proposed for identification of these features on a soil map if the feature(s) meet the above definition. However, soil improvement in the form of a surface berm or interceptor drain with surface berm may be necessary to adequately protect the area from groundwater and surface water interference.

A “one-dot” drain starts and ends where the actual accumulation or collection of water is concentrated in an area (channel) that can easily be identified. This type of drain usually has a maximum depth of 1 foot (12 inches). These drains may or may not have the potential to flood. The standard setback is 25 feet unless the soils consultant recommends a larger or smaller distance. Fifteen feet is the minimum setback to be recommended by a soils consultant.

A “two-dot” drain starts and ends where the actual accumulation or collection of water is concentrated in an area (channel) that is usually

more than 1 foot (12 inches) deep. This drain is more visible or defined than the one dot drain. These drains may or may not have the potential to flood the surrounding area. The standard setback is 25 feet unless the soils consultant recommends a larger or smaller distance. Fifteen feet is the minimum setback to be recommended by a soils consultant.

A "double-line" drain is usually big enough to be referred to as a creek, stream or river. These drains may flood the surrounding area and some may flood often. The minimum setback is usually 25 feet along drains of this size. The width of these drains may vary, but most are a minimum of 10 feet wide.

Cutbanks consist of banks, commonly but not exclusively, along sides of roads, borrow areas, mines, pits, construction excavation areas, and basements created by the mechanical removal of soil material from the area to expose the soil horizons or rock.

To be considered a cutbank the bank must be at least 12 inches in depth on slopes greater than 30 percent and at least 18 inches in depth on slopes less than 30 percent. Also, the slope of the cutbank must be greater than 30 percent.

2.8 Depth to Rock Classes

Statute 68-221-403 (f) requires 12 inches of undisturbed soil between trench bottom and top of bedrock in the areas of karst geology. However, the department may specify a lesser distance in a non-karst area. The Division's technical manual Letter of Explanation regarding this statute subsection identifies the minimum depth in non-karst areas as being an average of 6 inches. Given standard construction practices of 12 inches of gravel media and 12 inches of cover, 36" inches would be the minimum depth of soil over rock for permitting purposes in karst areas, and 30 inches in non-karst areas.

Karst area(s) is defined as "a type of topography that is formed over limestone, dolomite, or gypsum by dissolving or solution, and that is characterized by closed depressions or sinkholes, caves, and underground drainage" by the Glossary of Geology.

Statute 68-221-403 (i) allows for modifications to several standard construction practices allowing for depths of soil shallower than 36 inches (karst) or 30 inches (non-karst) to be permitted. Paragraph 1 of "i" allows for the depth of disposal field media to be reduced to a depth of either 8 inches or 10 inches. Paragraph 4 of "i" reduces the necessary depth of cover to 10 inches; at least 7 inches of which has to be natural and up to 3 inches may be compatible fill material. Paragraph 3 of "i" states that only

9" of undisturbed soil is required between trench bottom and rock. Paragraph 5 of "i", states the 18" requirement of subsection "f" does not apply to systems approved under "i". The 18-inch requirement of subsection "f" pertains to the 12-inch buffer required in karst areas. Therefore, by utilizing paragraph "i" to it's full extent it is possible to permit systems in soils with only a 24-inch depth to rock. Under "i" no differentiation is made between karst and non-karst areas.

When evaluating an area of soil for sewage disposal purposes it is critical that depth to rock be observed closely as this depth determines whether an area can be used and how it can be used. In fact, units of similar soil should be further divided if there are areas within the unit of soil that have limiting depths to rock.

Table 2.1
Depth to Rock Classes Relative To Subsection "i"

Inches of Soil to Rock	Disposal Trench Configuration (inches)		Minimum Buffer Required For All Systems Under "i" (inches)	Additional Requirements	
	Natural Cover	Disposal Field Media		Compatible Fill Material (inches)	Increase Footage By This Factor
24	7	8	9	3	1.5
25	8	8	9	2	1.5
26	7	10	9	3	1.2
27	8	10	9	2	1.2
28	7	12	9	3	1.0
29	8	12	9	2	1.0
30	9	12	9	1	1.0
31	10	12	9	0	1.0

Subsection "i" allows the most flexibility for permitting shallow soils; however, utilizing depths between and including 24 inches and 30 inches has consequences with respect to additional area required for permitting purposes and additional expense associated with system construction. Table 2.1 illustrates implications of mapping soils with less than 31 inches to rock.

If the minimum depth to rock identified for a unit of soil is 24 inches or 25 inches, the soil can be used but the footage requirements are to be increased by a factor of 1.5; and, 3 inches or 2 inches (respectively) of compatible fill material has to be added to the area of installation and extend approximately 5 feet beyond the area of installation.

If the minimum depth to rock identified for a unit of soil is 26 inches or 27 inches, the footage requirements are to be increased by a factor of 1.2; and, 3 inches or 2 inches (respectively) of compatible fill material has to be added to the area of installation and extend approximately 5 feet beyond the area of installation.

If the minimum depth to rock identified for a unit of soil is 28 inches, 29 inches, or 30 inches, the footage requirements do not have to increase; however, 3 inches, 2 inches, or 1 inch (respectively) of compatible fill material has to be added to the area of installation and extend approximately 5 feet beyond the area of installation.

As Table 2.1 indicates, 31 inches of soil are necessary for permitting systems under Subsection "i" without having to either increase footage requirements and/or add compatible fill material. However, if the area is non-karst, permitting under Subsection "f" would allow for a minimum soil depth of 30 inches to be used without modifying field line length or adding compatible fill.

The following examples are provided for clarification:

Example 1: If a soil map is submitted which identifies a soil unit with a minimum depth to rock of 24 inches, in order to permit this unit of soil for system installation the environmental specialist will have to increase the footage requirements by half again as much and require that 3 inches of compatible fill material be added to the area of installation.

Example 2: If a soil map is submitted which identifies a soil unit with a minimum depth to rock of 30 inches, the environmental specialist will have to consider whether the area is karst or non-karst before permitting. If the area is non-karst, the environmental specialist can issue the permit under Subsection "f" with the field lines installed at 24 inches and 6 inches of buffer. If the area is karst, in order to utilize the soil unit the environmental specialist will have to issue the permit under Subsection "i" and require 1 inch of compatible fill material.

Example 3: If a soil map is submitted which identifies a soil unit with a minimum depth to rock of 31 inches and it is in an area of karst, the environmental specialist can issue a permit under Subsection "i" and not require the addition of field line or compatible fill material.

Example 4: If a soil map is submitted which identifies a soil unit with a minimum depth to rock of 36 inches, the environmental specialist can permit a standard system under Subsection "f" irrespective of whether it is a karst or non-karst area.

In summary, the following depth to rock classes are recommended for mapping purposes (high intensity) when limiting depths to rock are encountered:

36 inches or greater -	allows for standard system construction without respect to karst or non-karst
31 inches or greater -	allows for systems to be permitted in karst areas under Subsection "i" without the addition of field line footage and/or compatible fill material
30 inches or greater -	allows for standard system construction in non-karst areas
24 inches to 30 inches -	allows for systems to be permitted under Subsection "i" with the addition of field line footage and/or compatible fill material

These same depth to rock classes, with the addition of a 20 inch depth to rock class, also apply to extra-high intensity soil maps. Areas of suitable soil with only 20 inches to rock may be considered for a modified mound permit.

2.9 Soil Drainage Classes

The following are general guidelines to be used in determining soil drainage classes.

Excessively drained soils are those soils that exhibit a rapid loss of water, either by percolation or by surface flow. The occurrence of free water is very rare or very deep. These soils are unsuitable for use if their absorption rate is less than 10 minutes per inch.

Well-drained soils have no redoxomorphic features within the upper 30 inches of the soil profile and do not typically require the application of soil improvement practices for sewage disposal purposes. However, well-drained soils may need protection if they are bordered by less well-drained soils.

Moderately well-drained soils have no redoxomorphic features within the upper 16 inches of the soil surface and have few redoxomorphic features within the 16 inch to 20 inch depth from the soil surface. These soils require soil improvement practices with few exceptions.

Somewhat poorly drained and poorly drained soils have some redoxomorphic features shallower than 16 inches, and dominant redoxomorphic features within the 16 inch to 20 inch depth from the soil surface. These soils are unfavorable for sewage disposal purposes due to high water levels that may occur for significant periods of time.

Some soils that are poorly or somewhat poorly drained are rated favorably in Appendix I. This rating is based on textural consideration only. Based on drainage class these soils are considered unsuitable. Footnote "4" of Appendix I suggests that these soils may be suitable if artificially drained. Permitting these soils for use with drainage will only be considered following review by a state soils consultant.

2.10 Soil Absorption Rates

Soil absorption rates are the rate that clean (potable) water can be absorbed into a soil or percolate through a soil during the period of time when conditions are least favorable. Least favorable rates generally are during the winter and spring seasons, while soils are near and above field capacity.

Soil absorption rates have been established for many soil series and some phases of soil series that have been recognized in Tennessee. The established soil absorption rates in minutes per inch (MPI) are listed by soil series and phases of some soil series in Appendix I of the Regulations to Govern Subsurface Sewage Disposal Systems. The estimated absorption rate for a soil series or a phase that has been recognized in Tennessee but has not been listed in Appendix I shall be established by the Division.

The estimated soil absorption rates listed in Appendix I or those established by the Division shall be the estimated soil absorption rate for those soils on both high intensity and extra high intensity soil maps, and for all kinds of subsurface sewage disposal systems. These rates are considered "optimum" rates. However, if a higher (slower) rate is more appropriate for a given unit of soil based on site-specific conditions (eroded phases, variable depth to restrictive layer…) the higher rate should be assigned to the unit. For example: the Mountview soils in Appendix 1 have an assigned rate of 45 minutes per inch. However, these soils increase in clay with depth. The typical pedon (TP) in the official series description (OSD) describes the soil as having brittle properties in 30 to 40 percent of the soil mass between depths of 25 and 28 inches. Between depths of 28 and 33 inches, 30 to 50 percent of the soil mass is described as brittle. Below a depth of 33 inches, the soil is described as a gravelly clay. Furthermore the Mountview soils are classified in an Oxyaquic

subgroup and are described as being well-drained or moderately well-drained.

Therefore, in places, the Mountview soils could be rated 60 or maybe 75 mpi between depths of 0 to 30 inches or 0 to 24 inches, respectively, as the site conditions dictate. Below a depth of 30 inches a greater than 75 mpi rating may be appropriate. Some sites may require subsurface drains. Guidelines presented in Section 2.11 should be considered when site-specific conditions necessitate assigning a higher rate than what is in Appendix I.

Typically, the lowest (fastest) soil absorption rate assigned to a soil unit will be associated with a specific depth within the upper 48 inches of the soil profile. If the depth associated with the lowest rate is less than 48 inches, a higher (slower) soil absorption rate may be associated with interim depths. In the above-mentioned example of Mountview soil, a rate of 60 MPI was assigned to a depth of 30 inches. The lower horizon in the soil profile to a depth of 48 inches shall also be assigned a rate in the soil notes as appropriate (i.e., 60 MPI to 30 inches, and >75 MPI from 31 inches to >48 inches).

The shallowest depth for which a rate should be applied to a given soil unit is 24 inches except for those soils that are to be considered for a modified Wisconsin mound system. A modified mound may utilize soils as shallow as 20 inches.

Some soils that are poorly or somewhat poorly drained are rated favorably in Appendix I. This rating is based on textural consideration only. Based on drainage class these soils are considered unsuitable. Footnote “4” of Appendix I suggests that these soils may be suitable if artificially drained. Permitting these soils for use with drainage will only be considered following review by a state soils consultant.

Where soil complexes or other multitaxa soil map units of two or more soils are used, the interpretations shall be for the most limiting soil in that soil map unit. Soils consultants have the authority to raise the estimated absorption rate for the lower subsoil layers in some soils in which there is evidence of groundwater interference, fragipan, clay, rock or other soil conditions likely to interfere with the installation or performance of a subsurface sewage disposal system. Soils consultants do have the responsibility and authority to recommend and require soil improvement practices where necessary to accomplish some soil absorption rates.

The authority to vary from the established soil absorption rates is 1200-1-6-.03(5), Additional Site Requirements and Limitations for Subdivision Approval and Individual Lots and Issuance of Construction Permit in the

Regulations to Govern Subsurface Sewage Disposal Systems. This authority requires that soils consultants recognize the need for drains and to require the appropriate kind and depth of installation of the subsurface drains. This authority does not allow soils consultants to establish absorption rates more favorable than the rates assigned in Appendix I of these Regulations.

The following guides shall be used by soil consultants to establish soil absorption rates for soil variants and for miscellaneous land types.

2.10.1 Estimated Absorption Rates for Soil Variants and Miscellaneous Land Types

Soil variants are soils that cannot be classified in any recognized soil series by the NCSS in Tennessee, but generally are so limited in extent that establishing new soil series is not practical. Soils consultants have the authority and the responsibility to determine the estimated soil absorption rates for soil variants. However, soils consultant regional supervisors will confirm these rates.

Some miscellaneous land types (for example gullied land and rock land) have been declared by regulation to be excluded from consideration for subsurface sewage disposal systems. Other miscellaneous land types may be considered for subsurface sewage disposal systems after they have been properly evaluated and demonstrated to have favorable properties for subsurface sewage disposal.

Filled land as defined in this Soils Handbook and the Regulations require an investigation, which in part requires an extra high intensity soil map that is further defined Section 4.3 of the Soil Handbook.

Graded land, as defined in this Soils Handbook, means areas from which the soil has been removed and the remaining soil cannot be classified in any soil series. That area may be evaluated with percolation tests if all the requirements to evaluate a site with percolation tests have been met per Regulation 1200-1-6-.02(3)(b).

2.10.2 Factors That Affect Soil Absorption Rates

Extrinsic Factors

Extrinsic site and soil properties that affect the development and performance of a soil are slope, configuration of the landscape and position on the landscape. The slope affects the rate of runoff and

infiltration rates for that soil. It affects the rate that soil and water are lost from the higher places, and the rate that soil (particles, material, or deposits) and water accumulate on other places. Slope, along with intrinsic soil properties, determines the rate and direction that water moves in the soil.

Intrinsic Factors

Intrinsic soil properties that affects the soil absorption rates are; size, shape, and distribution of macro pores. The soil texture, structure and consistence determine the size, shape, number and distribution of the pores in a soil.

Soil Color

Soil color is an important soil characteristic and is extremely useful in determining many soil qualities including drainage and permeability.

Uniformly red or brown soil colors in the upper thirty inches or more indicate that a soil is well drained. Reduced (gleyed) soils have chromas that are all or dominantly less than 2. Uniformly gray, black, or white soils or dominantly gray, black, or white soils because of wetness are poorly drained. These soils are wet (saturated or nearly saturated) for several days to several weeks in duration, several times each wet season.

In between uniformly red or brown soil colors and gray soil colors are soils that are mostly red or brown but have gray mottles (redox depletions) with or without concretions, nodules, or soft black accumulations (redox accumulations) are intermediate in drainage. They have been described as moderately well drained or somewhat poorly drained.

Soil Texture

Soil texture is the relative proportion of sand, silt and clay in a soil. It affects the quantity, size, shape and continuity of all pores. Generally the total pore quantity is greatest in the clayey soils, but the quantity of macro pores is greatest in coarser textured soils.

Soil Structure

Soil structure is the aggregation of individual soil particles in an orderly fashion. It determines the quantity of macro pores and the permeability of many soils. However, the soil permeability determines the type, grade and size of structural aggregates in many soils, especially those in medium and fine textural classes.

Soil Consistence

Soil consistence is the resistance of a soil mass of peds or clods to deformation. Generally, the loose consistence has the most macro pores and is most permeable; the friable and very friable consistence classes have moderate permeability. The macro pores and permeability decrease as the firm quality increases.

2.11 General Rating Guideline

2.11.1 Characteristics of a < 10 MPI soil

These soils consist of thick layers of gravel, sand, and loamy sand. Layers of fine textured soil, if present, are thin. On a weighted average basis, these have less than 70 percent of soil finer than very fine sand.

2.11.2 Characteristics of a 10 MPI soil

These soils consists of layers of sand, loamy sand, and gravel. Gravelly layers, if present are less than 3 inches in thickness and total gravel in the upper 30 inches is less than 35 per cent by volume. The total sand content, excluding very fine sand, is less than 70 per cent on a weighted basis.

2.11.3 Characteristics of a 15 MPI Soil

These soils are very young with no development, and are coarse in texture with very rapid permeability. These soils are well drained, deep and found along streams, flood plains, and on toe slopes of coarse textured materials. These soils are borderline on being excessively well drained**.** These soils have in the upper 30 inches or more, soil textures of loamy skeletal family particle size class as determined on a weighted basis. Layers of fragmental or sandy skeletal family particle size classes are not allowed. There may be thin layers of loamy textural family classes; loamy, coarse loamy, fine loamy, coarse silty, and fine silty may be present. These soils shall have 15 mpi estimated absorption rates depending on the thickness and number of loamy layers present.

2.11.4 Characteristics of a 30 MPI Soil

Well-drained 30 mpi soils have loamy, coarse loamy, fine loamy, coarse silty or fine silty family soil textural classes in the upper 30 inches or more of the soil as determined on a weighted basis. There shall be no evidence of excess wetness in the upper 30 inches of these soils. They may have depths to rock of 40 inches or more and are not underlain by depths to clay or fragipans within the upper 40 inches. These soils shall have an estimated absorption rate of 30 mpi in the upper 30 inches or more, depending on the soil textures. Loamy, coarse loamy and coarse silty soil textures shall have 30 mpi estimated adsorption rates.

Moderately well-drained 30 mpi soils (with soil improvement practices) have coarse loamy, coarse silty, fine loamy or fine silty soil textures and are friable to a depth of 30 inches or deeper.

2.11.5 Characteristics of a 45 MPI Soil

Well-drained 45 mpi soils have coarse loamy, coarse silty, fine loamy or fine silty soil textures and are friable to a depth of 30 inches or deeper. There shall be no evidence of excess wetness in the upper 30 inches of these soils. There shall be no restrictive or blocking layers such as fragipan, clay, rock, etc. in the upper 40 inches. Also, in this group are red (5 Y/R or redder) soils with high clay content but have friable consistence when moist. There are no redoximorphic features within 30 inches of the soil surface.

Moderately well drained 45 mpi soils (with soil improvement practices) have depths to excess wetness ranging from less than 20 inches to 30 inches. Depth to gray mottles ranges from less than 20 inches to 30 inches. There are no dominantly gray layers within 20 inches of the soil surface.

2.11.6 Characteristics of a 60 MPI Soil

These soils are generally well developed and permeable in the upper 30 inches of the soil surface. These soils should not have clays with high shrink/swell potential or mixed mineralogy in the upper 30 inches of the soil surface. These soils cannot have a fragipan within the upper 40 inches of the soil surface. They are usually well drained but may be moderately well drained.

2.11.7 Characteristics of a 75 MPI Soil

These soils have moderate to slow permeability in the upper 24 inches and generally have well developed profiles. They should not have clays with high shrink/swell potential or mixed mineralogy in the upper 24 inches of the soil profile. They must not have a fragipan within the upper 24 inches of the soil surface and must not have any fragic properties within the upper 22 inches of the soil surface. These soils include soils that have had special exemptions that allow for 20 inches to clay (Bradyville). These soils may be well drained or moderately well drained but must include soil improvement practices if moderately well drained.

2.11.8 Characteristics of a >75 MPI Soil

These soils have limiting properties in the upper 24 inches of the soil profile. Specifically, these soils have rock depths less than 24 inches from ground surface; fragipans less than 24 inches from ground surface; high (>35%) clay content less than 24 inches from ground surface; or, redoxomorphic features less than 16 inches from ground surface or very firm or firmer rupture resistance classes or is plastic and sticky when wet.

These soils may or may not be suitable for percolation tests per Regulation 1200-1-6-.02(3)(b).

3.0 Soil Map Compilation

Soil map compilation consists of accurately showing the kind, size, slope, extent and location of each soil map unit delineation on an acceptable base map to represent area on the earth's surface. It shows the spatial relation of each soil map unit delineation to other soil map unit delineations, other landscape characteristics, and to natural and cultural features.

Soil maps are of little or no use without soil notes that characterize each kind of soil map unit. Also, the soil notes, to be useful, must present interpretations that accurately predict the expected performance for sewage disposal purposes for each soil map unit.

3.1 Base Map Requirements for Soil Maps

3.1.1 Base Map Requirements for Soil Maps of Subdivisions

The base map requirements for preparing soil maps are specified in the Regulations by Rule 1200-1-6-.01 and by Rule 1200-1-6-.02 for general, high intensity and extra high intensity soil maps. These criteria are discussed in Chapter 2.

3.1.2 Base Map Requirements for Individual Lots

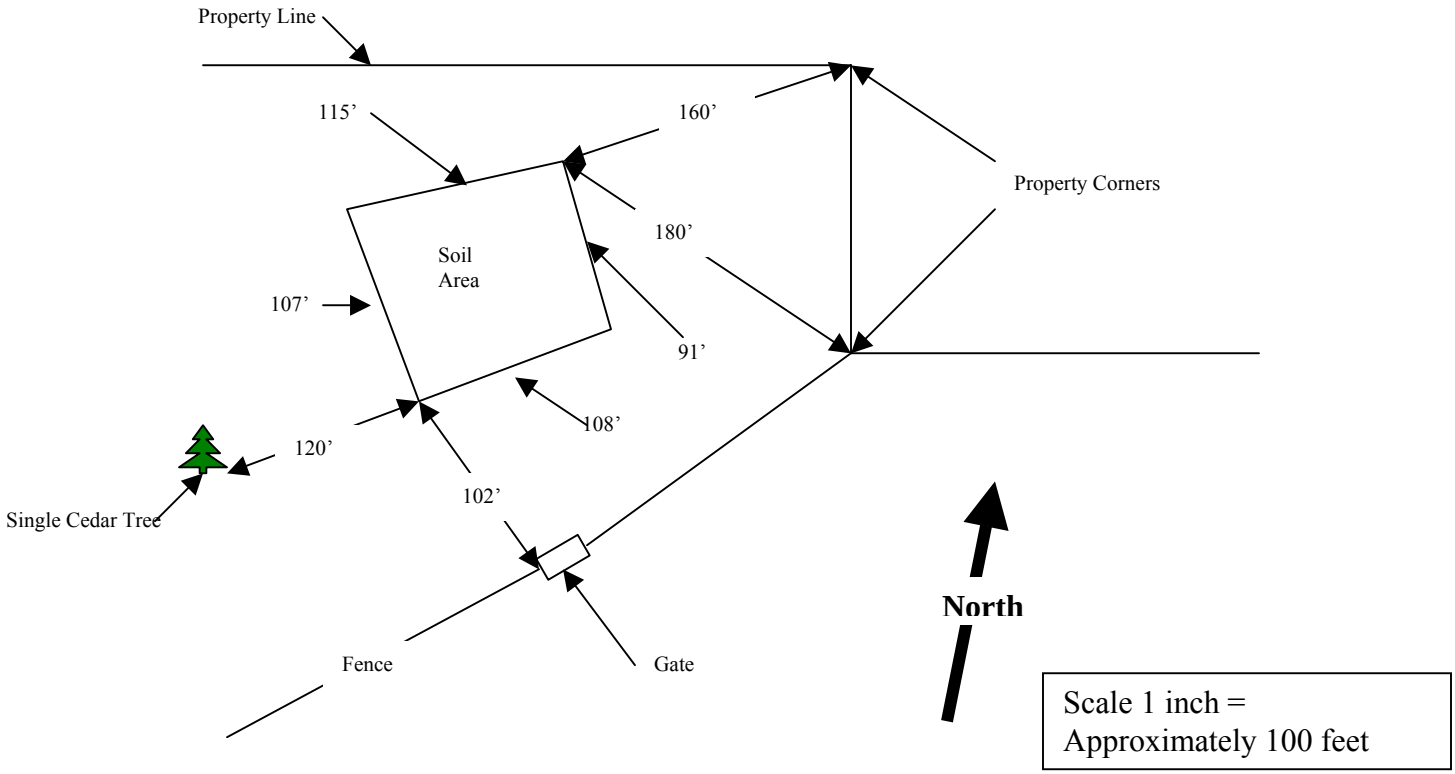
The Regulations under Rule 1200-1-6-.03 state in part: "For soils which are not a part of a subdivision herein, where the services of a soils consultant are utilized, then the requirements established in Rule 1200-1-6-.02 (3) (a) of the Regulations may apply as deemed necessary by the Department either on an area basis or site specific basis." Through this regulation, soils consultants are allowed to complete general and high intensity soil maps on sketches. Neither the seal nor the signature of a registered land surveyor is required on a sketch map. However, adequate information should be available on each sketch map to relocate the identified soil area in the event the stakes have been moved, removed or destroyed. In the event adequate information to locate a soil area is not presented on the map and relocation of the soil area is not possible, permit issuance based on the soil map will be delayed until that area has been restaked by the soils consultant or another suitable area has been located and mapped. In the event the original area is restaked, the soils consultant will be responsible for attesting to the accuracy of the restaked area.

Adequate information would include, but not be limited to, taped distances for the purpose of triangulating at least two of the soil

stakes for each soil area mapped. See Figure 3.1 for guidance relative to providing information used to triangulate points. Triangulated soil stakes should be roughly opposite each other within the pattern of stakes. Also, taped distances between the soil stakes should be provided on the soil map. Two triangulated soil stakes taped from permanent or semipermanent points along with stake to stake distances will allow for adequate reconstruction of a soil area. Use of metal "T" fence posts is recommended when formally staking the soil area.

In the event a sketch map is prepared, the north arrow and scale should be designated as approximate on the soil map. An approximate scale of 1"=100' is required for mapped soil areas on sketch maps. The absence of signature and seal of a registered land surveyor implies that all distances are approximate. All other base map requirements remain the same as the requirements specified in Rule 1200-1-6-.01 and 1200-1-6-.02.

Figure 3.1 Generalized Recommendation for Information Required for Soil Area Location on Sketch Maps



All Distances are Approximate (by taping).

Corners of Soil Area Marked with (flags, "T" posts, wooden stakes) on (Date).

3.2 Soil Map Unit Delineations

Each soil map unit shall be drawn and clearly plotted on the base map of each soil map that is being completed. Line size should be no greater than 1 millimeter in width if hand drawn. The map scale shall be the scale specified for the kind of soil map being completed.

Each soil map unit delineation shall be identified with an appropriate symbol or the name of the soils or miscellaneous land type printed in (or leadered into) the appropriate soil map delineation. The appropriate percent slope category should be included with each soil map unit label. If less than 24 inches of fill are present over the unit of soil, the word "Fill" and the 6-inch fill increment should be listed after the percent slope. Type of fill material should be explained in Column 4 for that unit of soil.

No other information (absorption rates, soil improvement requirements or subsurface sewage system design criteria) shall appear in any soil map unit delineation.

3.3 Soil Map Symbols

All significant cultural and natural landscape features such as buildings, cemeteries, pipelines, cut banks, drains, streams, wells, sinks, closed depressions, etc., shall be accurately located on the soil map with the appropriate conventional symbols that are provided as Appendix A. Ad hoc symbols may be used for cultural and natural features for which conventional symbols have not been established. Each ad hoc symbol shall be defined in the map symbol legend. Only those symbols used on the soil map shall appear in the legend.

3.4 Soil Map Notes

Soil notes for each soil map unit shall be printed on the front of each soil map. Soil notes shall be in a uniform and consistent format which makes the information easier to find and easier to interpret. Notes should not be stapled or taped to the soil map.

Only the soil notes that apply to the soils or miscellaneous land types that have been classified and delineated on a soil map shall appear on that soil map. Notes prepared mechanically or electronically are preferred. However, notes that are printed manually are acceptable if they are neat, legible and easy to use.

3.5 Format for Soil Notes

A standard format is necessary to ensure that the soil notes are organized

in a fashion that makes the necessary information easy to find and use. The tabular format consists of a form on which the county and site/subdivision name is identified at the top of the map and the name of the soils consultant, date of completion, and type of soil map are recorded at the bottom. In the middle there is a table in which there are four (4) columns. Each map unit should have a corresponding row in the table. Appendix B contains examples of completed tabular formats.

Column 1 in the table lists the soil map symbol (if used on the soil map), the name of the soil, and the depths to which the assigned absorption rates (Column 2) apply. Variable slope categories for an otherwise undifferentiated soil unit do not require multiple rows. The order of listing in Column 1 should be from the most prominent soil on the map to the least prominent soil on the map. If the map contains numerous units of soil and prominence is not obvious, list the units alphabetically. If less than 24 inches of fill are present over the unit of soil, the word "Fill" and the 6-inch fill increment should be listed after the percent slope.

Column 2 presents the estimated absorption rate for the corresponding depth in Column 1. The rate should be the same as what is listed in Appendix I or higher (slower) as site-specific conditions dictate. Successively lower horizons should also be assigned a rate down to a depth of 48 inches. Rates for lower horizons shall be higher (slower) than the rate assigned to the uppermost-identified horizon. For example: a map prepared in Dickson County may identify a unit of Mountview soil. In Column 1 for that soil unit would be the name Mountview (and symbol if appropriate) and the % slope for that unit. Appropriate soil depth ranges should also be listed in Column 1. For example 0 inches – 30 inches and 31 – >48 inches would be listed if the distinguishable profile change is located at 30 inches. Column 2 may read 60 MPI and >75 MPI if these rates apply to the depths listed in Column 1. Most importantly, the lowest (fastest) rate assigned to the soil unit is not lower than the rate identified in Appendix I. If a soil improvement practice is required to obtain a rate presented in this column, the appropriate indication should be made following the rate {i.e., 75 MPI (WID)}

Column 3 consists of the depths (in inches) to the upper level of bedrock or fragipan that is within a depth of 48 inches. Whether the depth is to bedrock or fragipan should be noted. Where no restrictive layer is within 48 inches, the symbol ">48 inches" shall be in this column for that soil or miscellaneous land type. Section 2.7 provides appropriate depth to rock classes to be used in this column when depth to rock is a limiting factor of the soil unit.

Column 4 consists of additional soil or site information that is needed to consider each kind of soil on the soil map for sewage disposal purposes.

Notes to be included in Column 4 include, but are not necessarily limited to: type of soil improvement required and the depth at which the improvement practice is to be applied; suitability of the soil for percolation tests; horizontal separation between subsurface drains, cut banks, and drainageways if different from the specified distances in the Regulations; properties of soil to be added as compatible soil; or, the presence and duration of excess surface and subsurface water. All of these notes may not apply to all soil units.

A general map note stating "control surface water" is not appropriate and shall not be placed on any soil map or in the soil notes. Any soil rate identified in the map notes that is dependent on a soil improvement practice should identify the practice within the notes for that soil type.

The following signature block and statements should conclude the soil note portion of the map:

(Type of Soil Map) Soil Map Completed by:

Signature Date
John Doe, Soils Consultant

The following statement shall be printed conspicuously near the soil notes:

ANY CUTTING, FILLING OR COMPACTION
WILL VOID THIS SOIL MAP

The following statements should also appear on the map:

"I, (Soils consultant's Name) affirm that this soil map meets the standards established in the Regulations to Govern Subsurface Sewage Disposal, the Soils Handbook, and the Soil Taxonomy. No other warranties are made or implied."

"Signature of Soils Consultant does not constitute approval of this map by the Division of Ground Water Protection."

Any disclaimer or statement that creates doubt about the nature and properties of a soil is not acceptable.

3.6 Vicinity Maps

Each soil map shall have a vicinity map printed on its front. It shall be accurate enough and legible to ensure that the soil map users can locate the site. The vicinity map need not be to scale.

3.7 Miscellaneous

Two copies of each soil map shall be submitted to the Commissioner on a plat that meets the requirements specified in the Regulations Section 1200-1-6-.02 (3) 2 (ii) with the exception for the exemption allowed for individual lots in the Regulations under Section 1200-1-6-.03 (1).

All soil maps with the exception of sketch maps shall require signature and seal of a registered surveyor, bar scale, and certificate of accuracy. All soil maps shall display a north arrow.

The boundary of the mapped area should be clearly delineated and identified on each soil map.

For the purpose of authenticating soil maps it will be necessary for each of the two soil maps submitted to the Commissioner to display a stamp over the soils consultant's signature and date of completion. Any other copy of the map to be considered original will also require the same authenticating process.

Stamps associated with professional organizations will be acceptable, as will stamps made specifically to represent an individual's approved status as a soils consultant in the State of Tennessee. Prior to applying the stamp the map should be signed and dated in blue, indelible ink. The stamp should be applied in a way to cover the signature and date.

4.0 Site Investigations

This chapter provides guidance for conducting site investigations or special investigations as required by Division personnel. These site investigations include evaluations conducted in support of a waste stabilization lagoon permit, modified mound permit, steep slopes, fill material, compatible fill, soil improvement/protection practices, closed depressions, and depth to rock maps for previously approved subdivision lots.

4.1 Waste Stabilization Lagoons

Subsequent to general characterization of an area of soil for lagoon suitability, the soils consultant must complete a site investigation. This investigation is to be conducted in accordance with Rule 1200-1-6-.14(5)(a) and in conjunction with a local environmental specialist qualified to prepare lagoon permits.

4.2 Modified Mound System

Characterization of a site for mound suitability will be assessed following completion of an extra-high intensity soil map for those soils with a depth of 24 inches or greater to a restrictive horizon.

For soils intended for modified mound systems that have 20 inches to 24 inches to a restrictive horizon, a special investigation must be completed. This investigation shall consist of providing profile data for each grid point of a 25-foot grid across the entire area for mound consideration and extending 25 feet beyond the area for mound consideration.

Grid point data shall include: a soil profile description which includes an assessment of matrix color, redox depletions, redox accumulations, texture, structure, consistence and all other important soil characteristics.

Data collected through this exercise should be presented in the form of a twenty-five foot grid extra-high intensity map with the attached point-specific profile information. The environmental specialist, with support from the state soil consultant, will interpret the data and determine site suitability.

4.3 Steep Slopes

Rule 1200-1-6-.03(4)(d) identifies slopes of more than 30 % as unsuitable unless soil conditions will prevent lateral movement of sewage effluent to the ground surface. Slopes greater than 50 % are considered unsuitable and not eligible for consideration.

The Division's policy SSD-011-8 addresses the use of steep slopes. This policy states that the investigation shall be conducted by an ***environmental specialist*** and an approved soils consultant and specifies that consideration be given to: presence, depth, and orientation of restrictive layers; depth of soil; limitations on the depth of the disposal field trenches; steepness of slope; and, any other conditions which would influence the lateral movement of effluent. Observations made in support of steep slope investigations should be made to a depth of 6 feet or bedrock, if shallower than 6 feet. Pits are required to assess these characteristics. The location and number of pits required to evaluate a site will vary based on site-specific conditions. A State Soil Consultant will determine the location and number of pits required.

The limitations of a steeply sloping site for a subsurface sewage disposal system depend in large part on the depth of suitable soil on the site and rock outcrops or cutbanks downslope of the site. Setbacks from these features will be determined on a site-specific basis. As the slope increases, the depth of suitable soil required increases.

The bottom of any planned or designed disposal field trench shall be at least six feet horizontal distance from the ground surface. Site-specific conditions may allow for variations in this distance.

4.4 Fill Material

Filled land is defined in the regulations as "areas to which more than two feet of soil and/or debris have been added." Rule 1200-1-6-.03(4)(a) states "Areas consisting of fill shall be excluded from the area considered for the installation of the disposal fields unless soil conditions provide for adequate filtration and will prevent outcropping of sewage effluent."

Division Policy No. SSD-011-8 states, "When application is made to utilize a site for subsurface sewage disposal which has fill material, an investigation shall be conducted by an environmental specialist and an approved soils consultant prior to determining the site for suitability."

There are several clues that are helpful in identifying fill. These clues include but are not limited to:

1. Randomly distributed masses of variable texture and colors
2. Buried modern artifacts such as cans, bottles, bottle caps, dish fragments, metal fragments, and waste building materials
3. Buried former surface layers that can be identified by properties such as organic matter content and gleyed organic matter that emits the odor of hydrogen sulfide

4. Masses or fragments of buried grass, tree leaves, and tree limbs
5. Layers and soil masses that remain from the filling process
6. Layers and masses of soil material with variable degrees of compaction
7. Anomalies in the landscape configuration such as banks and depressions
8. Photographs and contour maps that reveal landscape changes.

A high or extra-high intensity soil map should be prepared to identify and delineate the filled area. Where less than 24 inches of fill is present, fill depth shall also be noted on the map unit delineation and type of fill material specified. Less than 24 inches of fill shall be identified as either 0 inches to 6 inches, 6 inches to 12 inches, 12 inches to 18 inches, or 18 to 24 inches as appropriate. Soil units overlain with variable fill depth should be further delineated based on these depths of fill ranges. Smaller depth intervals may also be used if appropriate.

4.4.1 Filled Land Special Investigation

If more than 24 inches of fill material is identified, a special extra-high intensity soil map of the filled area is required. This map shall be one inch equals fifty feet or larger. Grid points should be staked and located on the base map at intervals of no more than twenty-five feet.

Observations shall be made to a minimum depth of four feet at each grid point. Observations can be made by auger borings or excavated pits. Additional observations may be necessary to ensure homogeneity of each identified map unit. No map unit should contain dissimilar bodies larger than 100 square feet. No more than 15 percent of the total area of any map unit delineation may contain dissimilar fill material or other soils.

A detailed profile description shall be completed at each grid point. Additional detailed profile descriptions shall be completed for each additional observation point. Each description shall reveal the significant characteristics and qualities of each significant layer in the profile at each grid point. Significant characteristics include but are not limited to the following:

1. Color
2. Texture
3. Consistence and Compaction
4. Structure
5. Debris

After observations have been made at each grid point and the profile for each observation location have been completed the map shall be completed. Map units shall be designed to provide homogeneity in each map unit and to provide the data needed to evaluate the site and design the appropriate subsurface sewage disposal system.

A variance from the Division's Central Office is required prior to permit issuance if the depth of fill over the area proposed for system installation is greater than 2 feet. The special investigation map with associated profile descriptions should accompany the variance request.

In support of the variance request a pit may be required within each map unit and a detailed profile description shall be completed for each pit. The Division Central Office shall be notified prior to pit excavation and a time suitable for all parties shall be established.

4.5 Compatible Fill Material

Several kinds of modified subsurface sewage disposal systems allow or require the addition of compatible soil material to the existing soil surface to make a site suitable.

Compatible soil material shall be a soil that is in the same USDA soil textural class as the existing surface soil layer on the site, or that is no more than one USDA soil textural class different from the existing surface soil layer. However, the textural class of "clay" is not considered acceptable as compatible fill material for any textural class of existing soil.

4.6 Soil Improvement/Protection Practices

Soil improvement/protection practices (SIP) are designed to collect, remove, and discharge interfering surface and/or subsurface water associated with subsurface sewage disposal systems (SSDS) while not collecting effluent from a SSDS.

These practices include, but are not limited to, interceptor drains, drawdown drains, surface berms, and "V" ditches. The drainage system may include one or any combination of these types of drains to accomplish the protection of the sewage disposal area.

Correct function of the SIP is critical in the overall performance of the SSDS. Correct function is influenced primarily by SIP construction and location of the SIP relative to the SSDS and to adjacent soil types.

It is the responsibility of the attending soils consultant to determine:

1. Whether or not a SIP is required
2. The kind of SIP that is required
3. The minimum depth at which the SIP shall be installed
4. The position on the landscape where the SIP shall be installed.
5. Distance of separation between SIP and disposal area.

It is also the responsibility of the soils consultant to state that a suitable outlet is required. It is not the responsibility of the soils consultant to determine whether or not a suitable outlet is available.

Regulatory Justification

Limitations for use of certain soils (for sewage disposal purposes), due to groundwater interference, are provided within the regulations. Rule 1200-1-6-.03 identifies additional site requirements and limitations for subdivision approval and individual lots and issuance of construction permits. Paragraph 1 of this section states that "the suitability of a site must be demonstrated through … freedom of groundwater interference…" Therefore, soils that exhibit interference from groundwater are considered unsuitable for subsurface sewage disposal. However, there are soils within this group that may be made usable by implementing soil improvement/protection practices (see Section 2.8).

Design

1. Subsurface Drains

   Subsurface drains can be divided into two general categories and are intended to intercept and successfully remove groundwater from soil areas designated for disposal field use:

   A. **Interceptor Drains** – Interceptor drains are constructed to intercept groundwater moving down slope within the soil profile prior to its entrance into the soil area intended for disposal purposes. When the direction of groundwater movement in the soil is apparent, the drain should be positioned upgradient of the soil area. In these settings interference of groundwater coming from the side slope or down slope direction would be considered minimal. Soils in which an interceptor drain would be used would typically have

a restrictive layer along which lateral movement of water is occurring. When the direction of groundwater movement in the soil is not apparent, the drain should be positioned to completely encompass the soil area. Completely encircling the soil area insures interception of interfering water regardless of its direction of flow. This type of drain would be a combination of an interceptor drain and a drawdown drain.

Degree of slope will typically determine whether a drain is to be positioned around all or a part of the disposal field area. The type of drain for a particular soil unit should be identified in Column 2 of the tabular note format. If the drain is to be positioned upgradient of the disposal field area, the soil rate in Column 2 for that soil unit should be followed by "(WID)". "WID" indicates that the rate listed for that soil unit is dependent on the installation of an interceptor drain. If the drain is to be positioned around the entire disposal field area, the soil rate in Column 2 for that soil unit should be followed by "(WCD)". "WCD" indicates that the rate listed for that soil unit is dependent on the installation of an interceptor drain that completely surrounds, or curtains, the disposal field area. Use of "WPD" to indicate that "planned" or "possible" soil improvement practices are suggested is not acceptable.

B. **Drawdown Drains** – Drawdown drains are constructed to lower the water table in the vicinity of the soil intended for disposal field use. They may be constructed to completely encircle the soil area or they may be positioned between the soil area and the local controlling feature for water table level (stream, lake, pond…). These soils may or may not have a restrictive layer.

If the rate assigned to a soil unit in Column 2 is dependent on a drawdown drain, "(WDD)" should be included following the rate. Any indication that an environmental specialist should "plan" for a drawdown drain but not require a drawdown drain on the permit will not be acceptable.

Subsurface drains must be installed within the unit of soil they are intended to improve. Placement of a subsurface drain outside the unit of soil it is intended to protect is only permissible following review by a State Soils consultant. Subsurface drains should not be installed further than 25 feet from the area of soil they are intended to protect.

Subsurface drains must be installed deep enough to intercept all interfering water and discharge it, while also diverting as much surface water as possible. The depth needed will be determined either by the depth of the disposal field lines, depth to the restrictive layer, or the depth needed to lower the high water table.

In soils exhibiting redoxomorphic features (wetness mottles, concretions, stains…) with a restrictive layer under a permeable soil layer the bottom of the drain should extend four (4) to six (6) inches into the restrictive layer to effectively block water from moving past the drain. In cases where the restrictive layer is rock, the drain should extend down to the rock surface. In those cases where the drain extends down to the top of rock, the gradient of the bottom of the ditch must be continuous. Obtaining continuous flow on top of rock may necessitate removal of bedrock (rock sawing or blasting). In no case can the bottom of the drain have any swags or depressions or isolated features that would restrict the flow of water. The gradient of the bottom of the ditch must be continuous to insure flow of water.

Where the purpose of the drain is to lower a high water table in a permeable soil with no blocking layer, the drain should extend at least twelve (12) inches below the bottom grade of the nearest disposal field trench. In some cases the depth of the drain may exceed 48 inches.

Subsurface drains must be installed far enough away from the septic tank and the disposal field to prevent septic tank effluent from entering those features. Generally, this will be a distance of fifteen (15) to twenty-five (25) feet. The exact distance will vary with the slope and the soil permeability.

2. Surface Drains

Surface drains can be divided into two categories and are intended to intercept and successfully remove interfering surface water from soil areas designated for disposal field use:

A. **Diversion Ditch** – A diversion ditch can be successfully used to intercept and divert surface water flow. Diversion ditches may be constructed to intercept isolated features that are directing surface water onto the soil intended for disposal field use or they may be constructed to completely shield a soil area from interfering surface water flow as might be encountered at the base of a slope.

B. **Vee Ditch** – A vee ditch may be used in place of a subsurface drain if the ditch can be dug and maintained deep enough to intercept the restrictive layer or water table and facilitate flow of interfering water away from the disposal field area.

4.7 Closed Depressions

Soil series within a closed depression may have properties similar to soils outside of a closed depression and are to be mapped/evaluated in the same manner. In many instances it is impractical to discern whether or not a site is within a closed depression. If it is determined that all or a portion of the soils being mapped/evaluated are within a closed depression, more intensive standards apply for their use as areas for installation of SSD systems.

Soil units shall be delineated as they exist according to series description, whether or not they are in a closed depression. When soil units are in a closed depression, the following guidelines apply:

1. The only additional note that must be added is that "the soil unit may be in a closed depression". The size and location of the closed depression in relation to the overall landscape may make this difficult to discern in some cases. The depths of restrictive layers, depth of soil improvement practices, soil rate, etc., as required in other applications, must be noted on the map and in the appropriate notes, as necessary.

2. If the closed depression has one or more open holes (throats), these features must be accurately located on the soil map. If the feature has any dimension greater than 5 feet, the perimeter of the opening shall be shown on the map as a solid line with inward-facing hachure marks. The feature should be shown to scale.

3. The minimum setback from physical features within an apparent closed depression such as throats and drains shall be in accordance with Rule 1200-1-6-.10.

4. Subdivision approvals may be granted and/or SSDS permits may be issued for suitable soils areas within closed depressions the same as outside closed depressions with the exception of the following more stringent criteria as specified by Rule 1200-1-6-.03(4)(c):

   a. Depth to rock formations shall be a minimum of four (4) feet from the surface of the ground.

   b. Trench depth shall not exceed 30 inches.

   c. Slopes must be 30% or less.

d. The area must not be subject to flooding. The term "subject to flooding" as used in the regulations shall refer to those soils that have indicators and characteristics of wetness developed from saturated soil conditions over prolonged periods and would not otherwise be usable even with the application of soil improvement practices. Some areas of closed depressions may also exhibit indicators of periodic ponding of water or seasonal flooding other than soil wetness characteristics. These indicators may be hydrophytic vegetation or the absence of vegetation. The term "subject to flooding" shall not be interpreted to indicate that all areas within a closed depression are unsuitable for the issuance of a SSDS permit.

e. Soil units that require soil improvement practices shall be considered unsuitable if the positive outlet is within 25 feet of a throat or if the positive outlet is below the elevation of any area determined to be subject to periodic ponding of water.

The soil consultant WILL NOT in any way, other than the suitability of the soils, indicate the suitability of the site for construction of a SSDS or as a building site.

4.8 Depth to Rock Maps for Previously Approved Subdivision Lots

This subsection outlines the process for preparing depth to rock studies associated with permit issuance on previously approved subdivisions or lots.

Frequently, the need for depth to rock information on previously approved subdivision lots arises during an environmental specialist's evaluation for permit issuance. Subdivision lots approved prior to 1990 (when removal of rock during field line installation was an accepted practice) often have a portion or all of the intended sewage disposal area underlain by shallow rock. When considering these lots for permit issuance, it is critical that areas with appropriate depths to rock are delineated.

Current soil mapping efforts should refer to Section 2.8 for rock depth classes and Section 3.5 for rock depth data presentation.

Data Collection

The grid should be field-staked at a minimum of 50-foot intervals. Field stakes should be established by survey. Data collection within the field stakes should be based on an alpha/numeric grid pattern with a minimum grid line separation of 10 feet. X-axis should be numerated. Y-axis should be lettered. X and Y coordinates should be clearly marked on each field stake. Field stakes should remain in place until the system is installed and approved.

Depth to rock datum in inches, as determined by rock probe refusal, should be determined for every grid point. A state soils consultant, on a site-by-site basis prior to data collection, may approve data collection methods other than rock probe refusal.

Persons qualified to collect depth to rock data are the same as those for performing percolation tests (Rule 1200-1-6-.04 Paragraph 7).

Data Presentation

Depth to rock in inches for each data point shall be recorded in table format. All rock outcrops on the surface of the ground, including those between grid points, shall be shown. This table should be presented on the same document as the property configuration with grid staking. The property boundary map with associated grid lines should have a minimum ratio of precision of 1:7,500 and shall bear the seal and signature of a Registered Land Surveyor. The scale of the map should be 1 inch equals 100 feet or larger (i.e., 1 inch equals 50 feet). Grid lines should be tied to a property corner or other permanent feature. Grid lines should be oriented parallel/perpendicular to property lines or in a north/south, east/west fashion if there are no adjacent property lines.

4.9 Drip Dispersal Mapping Requirements

These requirements are currently being generated.

5.0 Quality Control

Quality control is necessary to ensure that all soil classification, soil mapping and soil interpretations by all soils consultants meet the standards established for all soil maps and for all site investigations.

The established standards are the criteria established by the Soil Taxonomy, the Regulations, and the Soils Handbook of Tennessee by the Division. Ideally, quality control events will serve mainly as a learning experience to develop concepts, skills, and techniques to enable all soils consultants to perform adequately and in a similar fashion that yields similar results. However, these reviews must also serve to emphasize to those soils consultants who cannot or will not perform adequately, that soil maps and site investigations must meet the established standards.

5.1 Kinds of Quality Control Events

The two kinds of quality control events are Routine Quality Control Reviews and Non-Routine Quality Control Reviews. These reviews shall be made to evaluate soil maps and site investigations.

Routine Quality Control Events

Routine quality control reviews shall occur without reason to believe that either errors or omissions have been committed. These reviews shall be scheduled as time and resources allow. Priority in scheduling routine quality control events for individual soils consultants shall be commensurate with the volume of work done by each soils consultant in the area where soil maps are being reviewed.

Routine quality control events will involve local and regional Division environmental specialists. Staff environmental specialists will review each set of maps (at least 2) submitted to the respective county office based on the checklist included as Appendix C. Errors or omissions identified during this review will be communicated to the person supplying the map to our office. The map will not be accepted nor will it be used in support of subdivision evaluation or permit issuance until the errors or omissions have been addressed.

One of the maps in each set of maps submitted will be forwarded to the appropriate regional office. As each map is received in the regional office, an entry will be made to a log-in sheet identifying date of receipt, date of completion, soils consultant, name of map, county, and type of map (Appendix E).

State soils consultants responsible for reviewing soil maps will identify an appropriate percentage of maps from each contributing private soils consultant and conduct a field review to evaluate compliance with standards identified in Section 2.0, Soil Classification – Soil Mapping and Soil Interpretations. State soils consultants will also give consideration to compliance with Section 3.0, Soil Map Compilation, during the field review of the map. The quantity and location of maps selected for routine quality control reviews will be based on the soil map log maintained at the regional office.

Non-Routine Quality Control Reviews

Non-routine quality control reviews are scheduled to resolve problems with soil maps or site investigations as the need dictates.

Environmental specialists see all soil maps submitted to the Division. They also are involved in all site investigations. Therefore, most non-routine quality control events will begin at the county office level.

Non-routine quality control reviews will likely be initiated due to problems identified during system construction, or system failure subsequent to being loaded. Apparent problems may also be identified during subdivision evaluation and/or permit issuance.

The environmental specialist shall refer any soil map on which there appears to be errors and/or omissions pertaining to soil classification or soil mapping to the appropriate state-employed soils consultant. The soils consultant shall make a cursory evaluation of the soil map or site investigation and report to the appropriate SSCRS, who shall initiate the appropriate activities.

5.2 Results of Quality Control Events

Errors or omissions identified during the local environmental specialist review will be communicated to the person supplying the map to our office. The map will not be accepted nor will it be used in support of subdivision evaluation or permit issuance until the errors or omissions have been addressed. This communication will be informal as most errors identified at this stage are likely to be soils consultant oversights (i.e., no north arrow, no vicinity map, illegible notes…). However, if a particular soils consultant makes such errors repeatedly, the problem will be forwarded to the appropriate SSCRS.

Problems identified as the result of regional office soil map review, if minor, will be communicated to the responsible soils consultant and the appropriate local environmental specialist. If the problems are not

considered minor and/or are committed repeatedly, the appropriate state soils consultant supervisor will be contacted.

Each state soils consultant review of a soil map, whether a routine or non-routine quality control event, will result in a score based on the scoring process identified in Section 1.3.2, Field-Mapping Test. A goal of 10% of each individual soil consultant's soil map submittals will be targeted for a routine quality control review annually.

If the review results in a score of 100% (no loss of points), no notification will be made to the responsible soils consultant.

If the review results in a score of less than 100% but not less than 80% the responsible soils consultant will be made aware of the score by certified letter from the appropriate state soils consultant supervisor. This letter will identify the deficiencies associated with the map and offer the responsible soils consultant the opportunity to discuss the score if desired. However, the score (if passing) is not subject to review. A copy of this letter will be forwarded to the regional office file and county office file.

If the review of a map results in a failing score (less than 80%) a certified letter will be sent to the private soils consultant who prepared the map. The letter will identify:

1. Type of Quality Control Event
2. Date of Quality Control Event
3. Participants in the Quality Control Event
4. Map Score with Respect to Each of the Four Categories
5. Primary Reason(s) for Failing Score
6. Location of Property

If the review is a non-routine quality control event, the letter will also identify the reason the map was identified for review.

The soils consultant will have 30 days from the date of issuance of the letter to contest the score of the map. If the score is contested, the soils consultant will be responsible for requesting and coordinating an on-site meeting with the state soils consultant conducting the review and the state soils consultant supervisor for the area, if the supervisor was not the initial reviewer. The application for which the map was submitted in support of will not proceed until the issues are resolved.

Based on the results of this meeting the map score will either be changed or remain the same. This will be communicated to the soils consultant in a certified letter. The soils consultant will have 30 days following receipt of the letter in which to contest the score resulting from this meeting. The

Division Central Office will coordinate a review by multiple members of the SSCRS staff, if the score continues to be contested. The score resulting from this review will be considered final for the purposes of this quality control process.

When laboratory data are generated in the course of the review, these data will be considered definitive. When the soils consultant whose soil map is being reviewed chooses to have soil samples analyzed, any costs associated with collection and analysis of these samples will be borne by the soils consultant. For this data to be considered in the score of the map a state soils consultant shall oversee sample collection and the analysis should be conducted at a laboratory acceptable to the Division. Sampling protocol to be used should be discussed with the SSCRS and agreed upon prior to sample collection.

Map scores will be considered final if:

1. The score is not contested within 30 days
2. After contesting, the score is accepted
3. Score is based on review by multiple state soils consultant supervisors

Scores for all maps (passing and failing) will be maintained in each regional office. Failing scores, when finalized, will be forwarded to the Division's Central Office for appropriate disciplinary action.

5.3 Disciplinary Action

Upon notification of a finalized failing score for a soil map, the responsible soils consultant shall be notified of any disciplinary action(s) taken.

Action taken as the result of failing maps will take into consideration the date of completion of the map and the date of receipt for the first certified letter associated with the first failing map.

The disciplinary process will be specific to the type of deficiency(s) associated with the map. Similar and dissimilar types of deficiencies shall be defined by primary map categories identified in Table 1.1. There are four primary map categories. Within most of the categories there are multiple subcategories. Any mapping deficiency identified within the subcategories of a category will be considered to be the same type. For example: If the deficiency associated with the first failing map was associated with an inappropriate depth assigned for an absorption rate (subcategory A3), and the deficiency associated with the second failing map was an inappropriate designation of a soil improvement practice

(subcategory A5), the deficiencies would be considered the same type (Category A); and the second failing map would result in a step forward in the disciplinary process. Considering the same example for the first letter, but the second letter was the result of a deficiency associated with an inappropriate statement printed on the map (subcategory D4), the deficiencies would not be considered the same type; and the second failing map would actually be the first failing map for Category D.

TABLE 1.1
FIELD MAPPING SCORING PROCEDURE

Primary Map Category	Primary Map Subcategory	Point Value
A. Soil Classification	A1. Accordance with Soil Taxonomy and Official Soil Series Descriptions	25
	A2. Absorption Rate in Concordance with Appendix I	
	A3. Appropriate Depth Associated with Absorption Rate	
	A4. >75 MPI Soils Identified Correctly	
	A5. Appropriate Designation of Soil Improvement Practices	
B. Soil Map Unit Line Placement		25
C. Significant Features	C1. All Identified	25
	C2. Correctly Located	
D. Soil Notes	D1. Formatting and Legibility	25
	D2. Statement Omission	
	D3. Inappropriate Statements	
	D4. Legend and Symbols	
Total Points		100

The portion of points deducted from the total points for a category will be determined by the severity of the error. Minor errors or omissions shall be errors or omissions that: would not change whether a site was permitted or not; and, would not be expected to cause system failure due to undersizing. These types of errors or omissions (individually) would not typically result in a total loss of points for that category. However, multiple minor errors or omissions in a category may result in the loss of all points associated with a category. Minor errors or omissions are not

limited to the above-listed examples. Major errors or omissions that would typically result in a total loss of points for that category, and result in a failing score for the map, would be those errors or omissions that: caused a system to be undersized to the degree that failure would be expected; caused a system to permitted in unsuitable soil; presented a soil as unsuitable when it was actually suitable; did not adequately identify soil improvement practices; and, misuse of variant label. Major errors or omissions are not limited to the above-listed examples.

It is possible for one map to be significantly deficient in more than one category. If this is the case, the deficiency that is furthest along in the disciplinary process will determine the disciplinary action.

Example letter types are included as Appendix D.

First Failing Map

The first failing map will result in a certified letter to the soils consultant. This letter will identify the notable deficiency(s) with the map and serve as a warning with respect to continued disregard for Soil Handbook mapping standards (Letter Type A).

Second Failing Map

If the date of the second failing map is earlier than the date of receipt for the letter associated with the first failing map a letter (Letter Type B) will be sent to the soils consultant. This letter will announce to the soils consultant that all soil maps (old and new) prepared by the soils consultant will be **subject** to review for that type of deficiency. Environmental specialists and state soils consultants will conduct these reviews. Potential problems identified by environmental specialist review will be forwarded to the appropriate state soils consultant for consideration. All state soils consultant reviews will result in a soil map score.

If the date of completion for the second failing map is after the date of receipt for the letter associated with the first failing map, the following disciplinary action will be taken. A certified letter (Letter Type C) will be sent to the soils consultant identifying the notable deficiency(s) of the soil map and its similarity to the deficiency(s) noted in the first letter. The soils consultant will be made aware that all new soil map submittals considered for permit issuance or subdivision approval will be reviewed for a period of one year. These soil maps must be submitted directly to a SSCRS. State soils consultants will conduct these reviews. All state soils consultant reviews will result in a soil map score.

Third Failing Map

If the third failing map was generated before the date of the letter identifying the first failing map, a certified letter (Letter Type B) will be sent to the soils consultant identifying the notable deficiency(s) of the soil map and its similarity to the deficiency(s) noted in the first letter. This letter will announce to the soils consultant that all soil maps (old and new) prepared by the soils consultant will be **subject** to review for that type of deficiency. Environmental specialists and state soils consultants will conduct these reviews. Potential problems identified by environmental specialist review will be forwarded to the appropriate state soils consultant for consideration. All state soils consultant reviews will result in a soil map score.

If the third failing map was generated after the date of the letter identifying the first failing map, but before the date of the letter identifying the second failing map, the following disciplinary action will be taken. A certified letter (Letter Type C) will be sent to the soils consultant identifying the notable deficiency(s) of the soil map and its similarity to the deficiency(s) noted in the first and second letter. The soils consultant will be made aware that all new soil map submittals considered for permit issuance or subdivision approval will be reviewed for a period of one year. These soil maps must be submitted directly to a SSCRS. State soils consultants will conduct these reviews. All state soils consultant reviews will result in a soil map score.

If three failing map scores of the same type are accrued by a soils consultant and the third failing map was generated following receipt of the letter identifying the second failing map, the soils consultant will be summoned for a show-cause meeting at the Division's Central Office. Notification of this meeting, and the circumstances necessitating the meeting, will be communicated to the responsible soils consultant by certified letter (Letter Type D). The results of this meeting will determine whether the soils consultant's approval remains intact, is suspended, or revoked.

All soil maps prepared prior to the date of receipt for the Letter D Type will be reviewed and used at the discretion of a state soils consultant supervisor.

5.4 Suspension or Revocation

Division has the authority to confer upon the qualified candidates the status of approved soils consultants. Likewise, the Division, for the protection of the people and environment of the State of Tennessee, has

not only the authority but also the responsibility of revoking the approval of recalcitrant approved soils consultants.

The Regulations state in Rule 1200-1-6-.17(2)(a): "The Department may revoke or suspend the approval of any soils consultant for the practice of any fraud or deceit in obtaining the approval or any gross negligence, incompetence or misconduct in the practice of soil evaluation or any continued disregard of evaluation criteria as required by the Soils Handbook of Tennessee prepared by the Division of Groundwater Protection. Any person whose approval as a soils consultant has been denied, suspended, or revoked may request a hearing before the Commissioner by making such request in writing within thirty (30) days of the date of his denial, suspension, or revocation. Any hearing granted under this section shall be conducted in accordance with the Uniform Administrative Procedures Act, compiled in Title 4, Chapter 5, Part 3 of Tennessee Code Annotated."

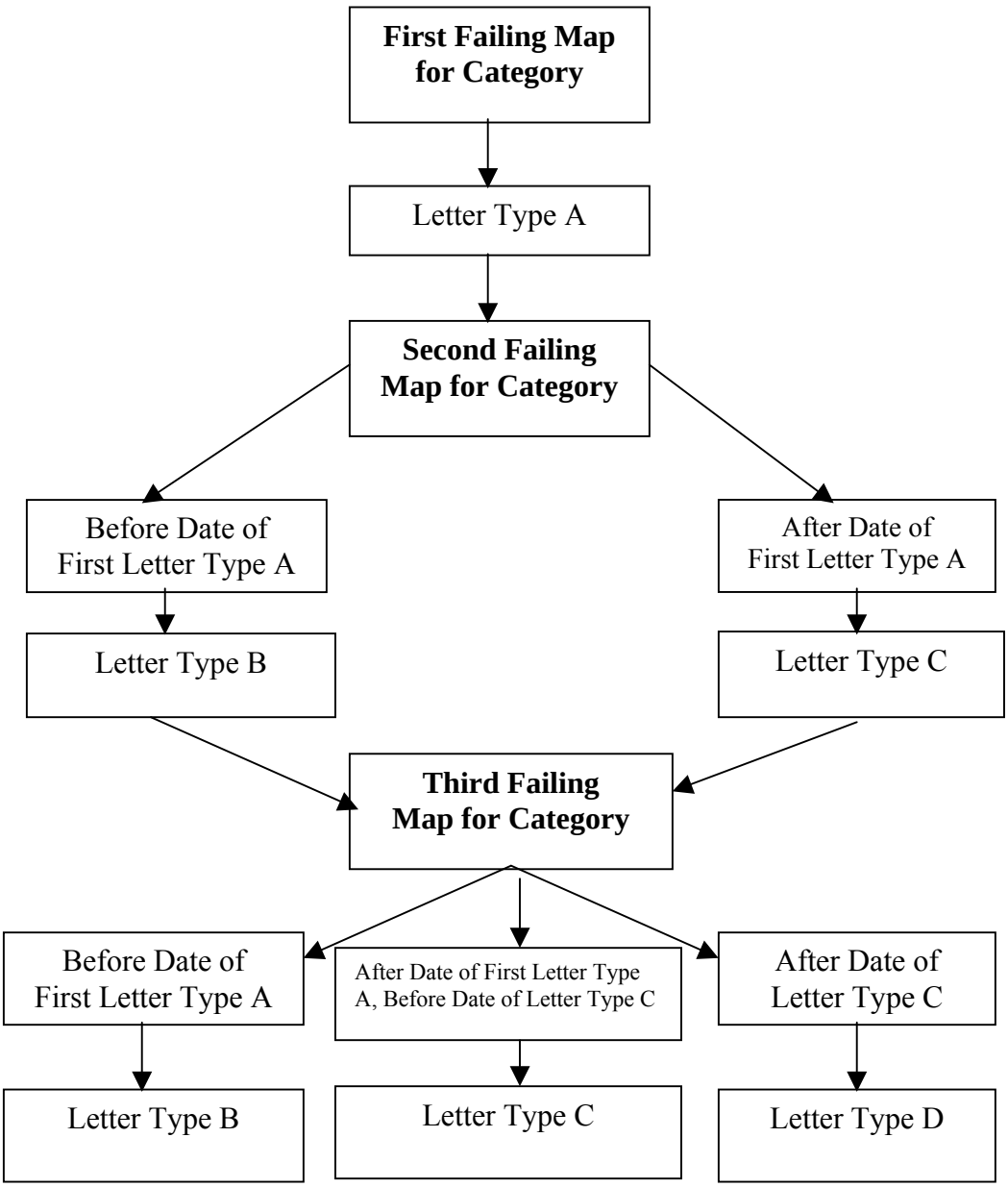
Any person whose approval has been suspended shall have the status of approved soils consultant reinstated on the first day after the suspension expires.

5.5 Reinstatement

If, after a period of one calendar year from the date of revocation from the list of approved soils consultants, the individual seeks to be considered for reinstatement the process, outlined in Section 1.0, shall apply in its entirety.

If subsequent mapping products are found to be deficient, the above-described disciplinary process (Section 5.3) will be followed with the following exception: only two failing soil maps with the same type deficiency(s) are necessary to result in a Letter Type D.

Figure 5.1
Disciplinary Flow Chart



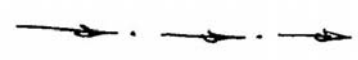
Letter Type A - Identify deficiency(s) and warn soils consultant regarding continued disregard.
Letter Type B - Identify deficiency(s), announce that all work (old and new) is subject to review and warn soil consultant regarding continued disregard.
Letter Type C - Identify deficiency(s), announce that all new submittals will be reviewed for a period of one calendar year and subject to review after one year, warn soils consultant regarding continued disregard.
Letter Type D - Identify deficiency(s), request show cause meeting to determine status of approval.

Appendix A

List of Standard Symbols

Streams, Drainways and Water Features -

- Intermittent Streams or Drainways - the lines are to be in the centerline of the feature and the arrowheads are to point in the direction of water flow. On level sites, arrowheads may be placed on each end of the line if the flow direction shall not be accurately determined.



One Dot Drain

This category includes areas having a more visible or defined drainway. The area of channelization is typically characterized as having a more distinct v-shaped cross-section and may or may not show any direct evidence of scouring on the ground surface. The contour of the landscape *will not allow* for the placement of SDS field lines across the course of the drainway.

Two Dot Drain

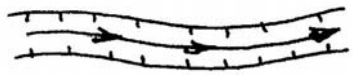
This category includes areas having distinctly visible drainways, 1 foot or greater in depth, with an obvious stream channel. The contour of the landscape will not allow for the placement of any SDS lines across the course of the drainway due to the steepness of the slopes or the depth of the drainway.

- Perennial Streams - the lines with arrowheads are to be in the centerline of the feature and the arrowheads are to point in the direction of water flow.

Stream, less than 10 feet wide

Stream, 10 feet wide or wider

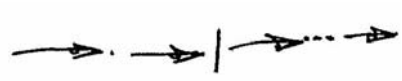
The plain solid blue line is representing the stream bank and it is to be plotted according to the crest of the bank.



Stream, 10 feet wide or wider

The stream symbol (blue ink) would be shown in the centerline of the feature and the stream banks may be represented with a embankment symbol (black ink) plotted according to the crest of the bank.

Miscellaneous Stream, Drainway and Water Features -



Change in Size of Drainway

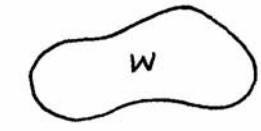
The drainway changes in size, for example from a one dot drain to a three dot drain, at the location of the short vertical cross line.

Erosional Drain

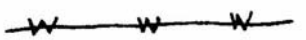
This category of drain describes a small, shallow drains (typically from 6 to 10 inches in depth) caused by activities of man.

Drainway Ends, Water Flow Dissipates

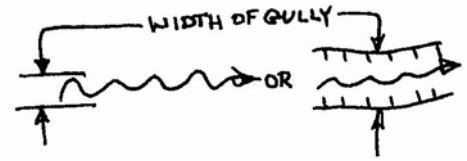
A plotted drainway, of any type and any obvious channel that the water was following along is no longer present, thus the water flow spreads out and dissipates.



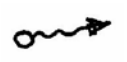
Pond, Lake or Any Other Body of Water
The solid line denotes the water's edge.



Waterline (if known to be actual waterline)



Gully
The width of the symbol on the map shall be scaled to represent the width of the feature on the landscape or embankment symbols shall be plotted on the map to represent the actual edges of the feature on the landscape.



Spring

Well

Wet Spot

Topographic Features -

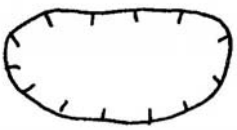
Bedrock Escarpments
Arrows point down slope

Escarpments other than Bedrock
Arrows point down slope

Short Steep Slope

Cutbank

Agricultural Terrace
The solid line is to be plotted as the crest of the feature and the tick marks are to show the downslope side of the berm. The arrow lines, ***DRAWN IN BLUE INK***, are to be plotted to represent the bottom of the trough.



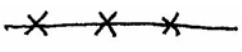
Closed Depression
This type of feature has no obvious surface outlet and typically shows evidence of ponding water, either after heavy rain events or seasonally.

Closed Depression with Throat

Small Sinkhole, Soil Pipe or Dropout
This symbol is to be used on these types of features where the diameter of the feature is 10 feet or less.

Miscellaneous Features, Natural and Cultural -

Rock Outcrops

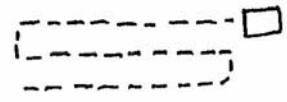


Pile of Material

This symbol is to be plotted showing the limits of material piled on a mapping site, typically by a dozer clearing land. The material may consist of rock, fill material, vegetative debris, etc.

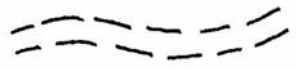
Fence (any type)

Buried Pipe (any type other than waterline)



Septic Tank and Field Lines

If this feature cannot be accurately plotted, simply delineate the general area and show as a map unit.

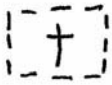


Vehicular Path

This symbol is to be utilized to show paths of vehicular traffic, such as a farm road, found on the land surface.

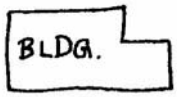
Ground Surface Road

This type of road may be paved or gravel (e.g. driveways or roads).



Cemetery

The perimeter of the cemetery is to be plotted as accurately as possible.



Building or Structure (any type)

The perimeter of the building or structure is to be plotted as accurately as possible.

Appendix B

Appendix C

Environmental Specialist Soil Map Checklist

Soil Map Name: _____

Soil Map Location: _____

County: _____ Date of Completion: _____

Soil Consultant: _____

Type of Soil Map: General High Intensity Extra-High Intensity

Base Map Criteria	Yes	No
North Arrow	☐	☐
Vicinity Map	☐	☐
Signature And Seal Of Surveyor (Except on Sketch Maps)	☐	☐
Certificate Of Accuracy (Except on Sketch Maps)	☐	☐
Two Original Copies Submitted	☐	☐
Appropriate Scale	☐	☐
No Inappropriate Statements Or Disclaimers On Map	☐	☐

Soil Map Criteria		
Soil Notes On Front Of Map	☐	☐
Appropriate Note Format	☐	☐
Legible Notes	☐	☐
Appropriate Statements On Soil Map	☐	☐
No Inappropriate Statements Or Disclaimers On Soil Map	☐	☐
Assigned Absorption Rates Meet Or Exceed (Slower) Rates In Appendix I	☐	☐
Boundary Of Mapped Area Adequately Defined	☐	☐
Appropriate Map Unit Labels	☐	☐
Symbols Used On Soil Map Are Defined In Legend	☐	☐
Symbols Not Used On Soil Map Are Not Included In Legend	☐	☐
Appropriate Slope Class Identified In Soil Notes	☐	☐
Appropriate Line Size For Soil Boundaries	☐	☐
Only Soil Notes Appropriate For That Map Are To Be Presented On The Map	☐	☐
Profile Description For Soil Variants	☐	☐
Greater Than 75 MPI Soils Identified As To Suitability For Percolation Tests	☐	☐
Soil Improvement Practices Explained	☐	☐
Each Map Displays Stamp Over Soil Consultant Signature And Completion Date	☐	☐
Adequate Soil Area Relocation Information (Sketch Map)	☐	☐
Minimum of 20,000 square feet of soil area mapped for each lot	☐	☐
Soils Consultant on Approved List	☐	☐
Signature Of Soil Consultant And Completion Date In Blue Indelible Ink	☐	☐

Appendix D

RE: *SOIL CONSULTANT* Responsible Soil Consultant
MAP NAME Map Name
DATE Date of Completion
LOCATION Location
COUNTY County

Dear *SOIL CONSULTANT*,

On *DATE* a quality control review event was conducted involving the above-described soil map. Participants in this event were *ALL PARTICIPANTS*, and myself.

This review was conducted as a *non-routine or routine* quality control event. If non-routine, The reason for this review was due to *PROBLEMS IDENTIFIED AT THE TIME OF PERMIT ISSUANCE, PROBLEMS ENCOUNTERED DURING SYSTEM CONSTRUCTION, FAILING SYSTEM …*.

The score resulting from this review (*SCORE*) was passing however some deficiencies were identified:

1.
2.

If you would like to arrange a time to meet with me on site to discuss these deficiencies please contact me at *PHONE NUMBER*. The above-listed score is not subject to contest.

While the identified deficiencies did not result in a failing map score, continued disregard of the mapping standards associated with these map attributes may result in failing map scores.

OR

The score resulting from this event was failing (*SCORE*). The primary deficiencies resulting in this score were:

1.
2.

If you wish to contest the score of this map please contact me in writing within 30 calendar days of your receipt of this letter. If you decide not to contest the map score it will be deemed final following the 30-day period. If finalized, you will be notified by letter. The Central Office will be copied on this letter and disciplinary action will be initiated.

Sincerely,

State Soil Consultant II or,
State Soil Consultant Regional Supervisor

Copy: Regional Office

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT* ,

On *DATE* , we received your letter of contest for the map score associated with the above-described soil map. On *DATE* we met at the property to provide you the opportunity to defend the map. As a result of the meeting, the (*map score was modified to a passing score*) or (*the map score remained the same*).

If you wish to continue contesting the score of this map please contact me in writing within 30 calendar days of your receipt of this letter. If you decide not to contest the map score it will be deemed final following the 30-day period. If finalized you will be notified by letter, and the Central Office will be copied. The Central Office will initiate disciplinary action.

Sincerely,

State Soil Consultant II or,
State Soil Consultant Regional Supervisor

Copy: Regional Office

DRAFT VERSION (August 7, 2007)

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT* ,

On *DATE* , we received your second letter of contest for the map score associated with the above-described soil map.

On *DATE and TIME* , State Soil Consultant Supervisors, *PARTICIPANTS* will meet with me at the site. You are welcome to attend this meeting. The score resulting from this meeting will be considered final and not subject to further state review. If you intend to submit laboratory data to support your continued contest of the map score, it will be necessary for you to make arrangements to have the data available at the time of this meeting.

If, following consideration by multiple state soil consultant supervisors, the score for the map continues to be a failing score you will be notified by letter, and the Central Office will be copied. The Central Office will initiate disciplinary action.

Sincerely,

State Soil Consultant II or,
State Soil Consultant Regional Supervisor

Copy: Regional Office

DRAFT VERSION (August 7, 2007)

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT*,

On *DATE* , State Soil Consultant Supervisors, *PARTICIPANTS*, and myself visited the above-described location to assess the failing score earlier assigned to your soil map. Based on our review the failing score was upheld. This letter is to inform you of this finalized failing map score (*SCORE*). A copy of this letter will be forwarded to the Central Office for disciplinary action.

The category type(s) for this failing map is Category *A,B,C,D*.

Sincerely,

State Soil Consultant II or,
State Soil Consultant Regional Supervisor

Copy: Regional Office
Central Office

LETTER TYPE A

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT,*

The Division of Groundwater Protection's Central Office has been informed of a finalized failing map score assigned to the above-referenced soil map. The deficiency(s) identified on this soil map is associated with Category *A,B,C,D* of the Field-Mapping Test criteria identified in Section 1.3.2 of the Soil Handbook. This score was finalized through the process identified in Section 5.2 of the Soil Handbook. This is your first failing map score associated with this category.

This purpose of this letter is to identify your position within the disciplinary process and warn you that any further disregard for soil mapping standards identified in the Soil Handbook will result in more severe disciplinary action (Section 5.3 of the Soil Handbook).

If you have any question regarding this matter please call *CENTRAL OFFICE REPRESENTATIVE at PHONE NUMBER*.

Sincerely,

LETTER TYPE B

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT,*

The Division of Groundwater Protection's Central Office has been informed of a finalized failing map score assigned to the above-referenced soil map. The deficiency(s) identified on this soil map is associated with Category *A,B,C,D* of the Field-Mapping Test criteria identified in Section 1.3.2 of the Soil Handbook. This score was finalized through the process identified in Section 5.2 of the Soil Handbook. This is your second failing map score associated with this category; however, the date of this map is prior to the date of the letter associated with the first failing map for this category.

This purpose of this letter is to identify your position within the disciplinary process and warn you that any further disregard for soil mapping standards identified in the Soil Handbook will result in more severe disciplinary action (Section 5.3 of the Soil Handbook). Also, all soil maps (old and new) are subject to review for that type of deficiency. Environmental specialists and state soil consultants will conduct these reviews.

If you have any question regarding this matter please call *CENTRAL OFFICE REPRESENTATIVE at PHONE NUMBER*.

Sincerely,

LETTER TYPE C

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT,*

The Division of Groundwater Protection's Central Office has been informed of a finalized failing map score assigned to the above-referenced soil map. The deficiency(s) identified on this soil map is associated with Category *A,B,C,D* of the Field-Mapping Test criteria identified in Section 1.3.2 of the Soil Handbook. This score was finalized through the process identified in Section 5.2 of the Soil Handbook. This is your second failing map score associated with this category. The date of this map is after the date of the letter associated with the first failing map for this category.

This purpose of this letter is to identify your position within the disciplinary process and warn you that any further disregard for soil mapping standards identified in the Soil Handbook will result in more severe disciplinary action (Section 5.3 of the Soil Handbook). Also, all new soil map submittals considered for permit issuance or subdivision approval will be reviewed for a period of one year. These soil maps must be submitted directly to a SSCRS. State soils consultants will conduct these reviews.

If you have any question regarding this matter please call *CENTRAL OFFICE REPRESENTATIVE at PHONE NUMBER*.

Sincerely,

LETTER TYPE D

RE:	*SOIL CONSULTANT*	Responsible Soil Consultant
	MAP NAME	Map Name
	DATE	Date of Completion
	LOCATION	Location
	COUNTY	County

Dear *SOIL CONSULTANT,*

The Division of Groundwater Protection's Central Office has been informed of a finalized failing map score assigned to the above-referenced soil map. The deficiency(s) identified on this soil map is associated with Category *A,B,C,D* of the Field-Mapping Test criteria identified in Section 1.3.2 of the Soil Handbook. This score was finalized through the process identified in Section 5.2 of the Soil Handbook. This is your third failing map score associated with this category. The date for this map is after the date of the letter associated with the second failing map for this category

This purpose of this letter is to identify your position within the disciplinary process and summon you to attend a show-cause meeting at the Division's Central Office. The purpose of this meeting will be to provide you an opportunity to defend your position. You may be accompanied by legal council. The outcome of this meeting may result in the suspension or revocation of your approval as a soil consultant in the State of Tennessee.

To arrange a suitable date and time for this meeting please call *CENTRAL OFFICE REPRESENTATIVE at PHONE NUMBER*.

Sincerely,

Appendix E

Log In Number	Log In Date	Date Map Completed	Soil Consultant	Map Name	County	Map Type (G,H,E)	State Soil Consultant Office Review (Date/Initials)	State Soil Consultant Field Review (Date/Initials)
